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DISCOVERY

A Monthly Popular Journal of Knowledge

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THE SHELDONIAN THEATRE, OXFORD.

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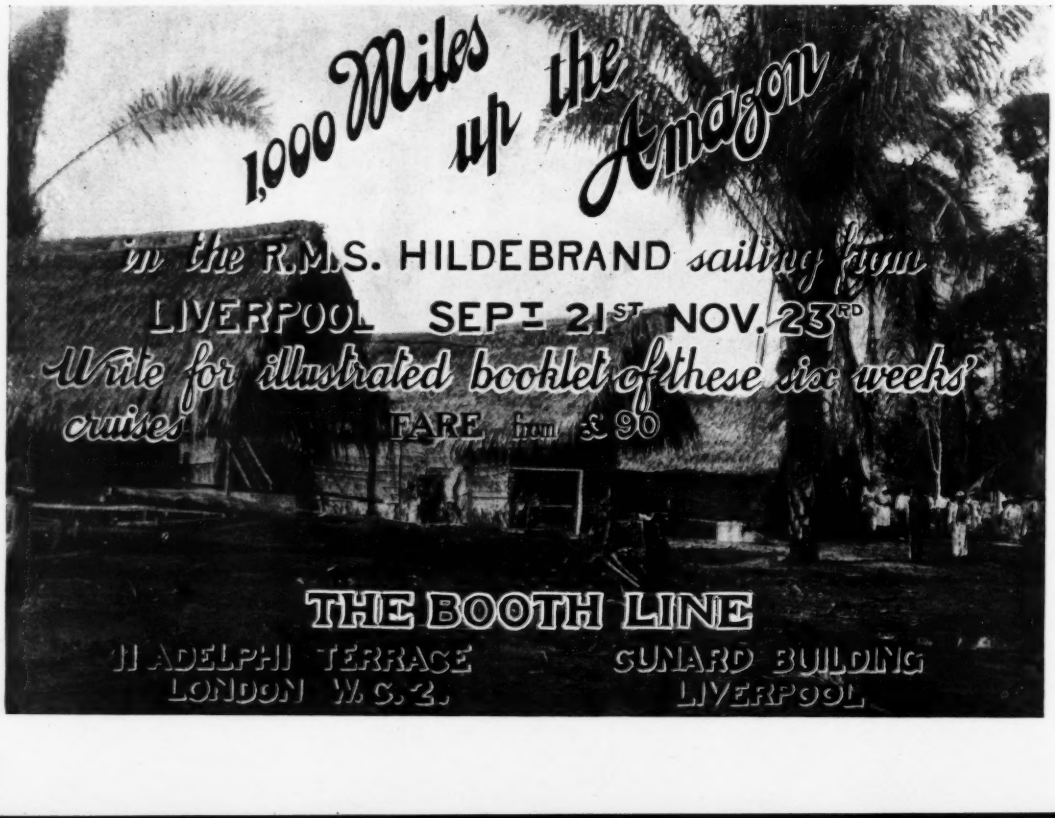
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Editorial Notes.

This month the British Association for the Advancement of Science will have the honour to meet under the presidency of the Prince of Wales, when it assembles at Oxford for its annual meeting. The Prince of Wales follows the Prince Consort as the second member of the royal family to be president of the British Association, although his relations with that body will not begin when he succeeds Professor Horace Lamb in the chair on 4th August. At Cardiff, in 1920, members offered their congratulations upon the successful labours of His Royal Highness during his imperial tour.

When the Prince Consort presided at the Aberdeen meeting in 1859, he was not a stranger to the Association, having attended its annual meeting in 1846; but, as its present secretary writes in *A Retrospect* of the Association's activities, published in 1922, the thought of appearing in the presidential chair evidently caused the Prince Consort some apprehension; it is recorded that he "dreaded failure." The Queen, however, was able to write that "his great undertaking went off extremely well." We may be allowed, in all loyal humility, to express our confidence that Queen Victoria's judgment will apply no less to the function which the Prince of Wales is this year to perform.

At the last British Association meeting at Oxford, an experiment was performed, the effects of which were destined to reach so far that even to-day their possibilities are only beginning to be divined. Sir Oliver Lodge gave the first public demonstration of wireless telegraphy, and this he discusses in his reminiscences of the 1894 meeting which appear on another page.

* * * * *

Every member visiting Oxford this month is being presented with a copy of this issue of *Discovery*; Sir Oliver's article, read by those to whom "wireless" is commonplace, cannot fail to stir the imagination, and to give rise to the reflection that every meeting of the Association is likely to witness the early results of some pioneer research. *Discovery* has for its aim a popular description of the advance made in the chief subjects in which investigations are being actively pursued; many of its articles deal with matters as yet in process of investigation—others record results which are definitely established. The present number will be in the hands of many new readers, whose co-operation we invite in an endeavour which is believed to be filling a definite need; and if it can succeed in arousing new and deeper interest in the search for many kinds of truth among those attending the Oxford meeting—and among many others who are unable to do more than read or even glance at its reports—the purpose of *Discovery* will be to that extent further achieved.

* * * * *

The establishment of a bureau for the distribution of scientific information under the patronage of the British Science Guild and the British Association, has for some time been discussed. In considering the project, our distinguished contemporary *Nature* points out that popular accounts of research which has led to new knowledge are also needed. "Experience having shown," says *Nature*, "that as a rule, the research-workers and inventors are ill-fitted to describe their work in a manner understood by the people, the writing should be done by those who have the gift of popular exposition, though the materials therefor should, when possible, be supplied, and the manu-

scripts revised, by the discoverers." While heartily endorsing any scheme which tends to further a wider interest in knowledge, we venture to demur to the suggestion that as a rule research-workers cannot describe their results in an intelligible way. This dictum does not seem, in our opinion, to do justice either to the scientist or to the lay reader. It may be compared to the well-intentioned but quite useless practice of lecturers of a certain type, who are at pains to explain to their students that such and such a corollary might be mentioned were it not too complicated for them to follow.

* * * * *

Discovery was founded as a medium through which experts could enable plain men to share their interest in research. The hope which its first editor expressed, that such men should write "not in the language of their specialism but in that simple tongue which plain men understand—namely, English," has, we suggest, been conclusively demonstrated in *Discovery*, and we owe to them no small gratitude for their co-operation. Happily the old-fashioned idea that anything intelligible to the plain man could not be scientific has received many hard knocks from the work of many brilliant writers who are also scientific in every sense; and the growing interest of those who have neither time nor opportunity to pursue specialized study, but who do not find satisfaction in the generalities, however pretentious, of uninstructed, or less instructed, journalism, has amply justified the view we venture to maintain.

* * * * *

Readers of *Discovery* may remember that in 1920 Professor W. M. Calder explained in its columns an important discovery, made by him and Sir William Ramsay, which justified completely the statement of S. Luke's Gospel that the Roman General Quirinius was Governor of Syria at the beginning of the Christian era—a statement which had been fiercely challenged by Mommsen on what seemed strong grounds. This spring Professor Calder has again been exploring, in conjunction with Mr. W. H. Buckler of Baltimore, on behalf of the American Society for Archaeological Research in Asia Minor. "On the morning of 13th May" they found a stone altar close to the site of the ancient Lystra, dedicated to two deities of whom the second was Hermes and the first the "Hearer of Prayer," whom they have good reason for identifying with Zeus. This inscription proves beyond a doubt that these two deities were worshipped together at Lystra and entirely confirms S. Luke's account in the Acts of the Apostles in which, as everyone remembers, Barnabas and Paul were deified as Jupiter and Mars or, as they are called in the Greek, Zeus and Hermes. Some evidence, though less explicit, of a similar joint-worship had been found in another valley remote from Lystra. But this actual discovery on the spot is of much greater interest; and we hope that Professor Calder will be willing to give a fuller account of the stone in an early number.

* * * * *

A quarterly that will appeal to every reader of *Discovery* has just been inaugurated by the Trustees of the British Museum. This is to contain illustrated descriptions of the latest acquisitions made by the various departments at Bloomsbury, which "will not be too technical for the layman, and will give the expert at least part of what he needs to know." The new publication is in large measure the successor to the exhaustive return that was made annually by the trustees up to the year 1921, when the curtailed form (necessitated in the interests of economy during the latter years of the war), was made permanent. The form of the new quarterly, however, entirely distinguishes it from the official return, of which—to use the words of the Director in his introduction—"it cannot be said that the descriptions, even of the most important objects, erred on the side of exuberance, and the volume had all the austerity of an unillustrated Blue Book." Beautifully printed by the Oxford University Press, the new publication certainly justifies Sir Frederic Kenyon's prediction "that, as the series grows, a set of volumes containing the picked acquisitions in all departments of the British Museum over a term of years will be a not unimportant addition to the library of art and archaeology."

* * * * *

In the first issue of the *British Museum Quarterly* a statuette of Socrates, found recently in Alexandria, and acquired by the Department of Greek and Roman Antiquities, is described; the other contents, which indicate the scope of the journal, include articles on a Roman cinerary urn of the third or second century B.C., a mediaeval bronze bowl, a gold bowl from Hungary, and a gold armlet from the British Bronze Age; the original draft of the last two chapters of Jane Austen's "Persuasion"—the only extant MS. of any portion of the six main novels; a T'ang silver figure and a T'ang silver hoard, this last article being the most profusely illustrated; a colour print, *La Folie*, by Francois Janinet, a southern landscape by Decamps; the Seager bequest of coins; and a Sarum book of hours of 1494. The museum quarterly proposes, in addition, to call attention to the temporary exhibitions periodically installed in the galleries.

Reminiscences of the last British Association Meeting in Oxford. 1894.

By Sir Oliver Lodge, F.R.S.

Now that the British Association for the Advancement of Science is going to meet this year in Oxford, between 4th and 11th August, it may be of interest to look back thirty-two years to the last previous meeting at Oxford in 1894. For many subjects which were then (like the President-elect for 1926) in their infancy have developed enormously in the interim—notably Hertzian-wave or radio-telegraphy, but many others also, as a glance at the titles of the papers then read to the sections will show. It is indeed remarkable what progress can be made in a period so short as thirty-two years.

There had been many previous meetings at this ancient university city. The Association itself was born in the year 1831 at York, but the very first meeting after that took place in Oxford, in June 1832. The next was also in June of 1847, and again in 1860. It was in 1860 that that dramatic encounter occurred between the apostles of evolution and the upholders of theological orthodoxy; in which controversy Huxley was the most famous scientific protagonist—an incident which is well known and has often been described.

Lord Salisbury's Address.

After that there was a long interval, during which many commercial towns competed for the privilege of entertaining the Association, and Oxford had no further meeting till August 1894, when it was presided over by Robert Cecil, F.R.S., Marquis of Salisbury. Looking back at the previous meeting, in his presidential address, Lord Salisbury referred to the controversy between what he called the mental sciences and the growing sciences of observation, as follows:—

"The warmth of the encounters which then took place have left a vivid impression on the minds of those who are old enough to have witnessed them. That much energy was on that occasion converted into heat may, I think, be inferred from the mutual distance which the two bodies have since maintained. . . . It has required the lapse of a generation to draw the curtain of oblivion over those animated scenes. It was popularly supposed that deep divergences upon questions of religion were the motive force of those high controversies. To some extent that impression was correct. But men do not always discern the motives which are really urging them, and I suspect that in many cases religious apprehensions only masked the resentment of the older learning at the appearance and claims of its younger rival. In any case, there is something worthy of note, and something that conveys encouragement, in the difference of the feeling which prevails now and the feeling that was indicated then. Few men are now influenced by the strange idea that questions of religious belief depend on the issues of physical research. Few men, whatever their creed, would now seek their geology in the books of their religion, or, on the other hand, would fancy that the laboratory or the microscope could help them to penetrate the mysteries which hang over the nature and the destiny of the soul of man."

Mendeléeff's Periodic Law.

Lord Salisbury then naturally dealt with the chemical and physical problems in which he was himself interested, speaking of the spectroscopic measurement of motion in the line of sight, by Huggins, and some of the other early discoveries of spectrum analysis. He next refers to the periodic law of the chemical elements, then not long since established by Newlands and Mendeléeff, and mentions the gaps in the series and the possibility of predicting the properties of the elements which should fill those gaps,—predictions which were fulfilled when some of those elements were discovered:—

"This remarkable confirmation has left Mendeléeff's periodic law in an unassailable position. But it has rather thickened than dissipated the mystery which hangs over the elements. The discovery of these co-ordinate families dimly points to some identical origin, without suggesting the method of their genesis or the nature of their common parentage. If they were organic beings all our difficulties would be solved by muttering the comfortable word 'evolution'—one of those indefinite words from time to time vouchsafed to humanity, which have the gift of alleviating so many perplexities and masking so many gaps in our knowledge."

Eliminating the slight element of sarcasm in this sentence, its foresight has been abundantly justified by the discovery—now well established—that all the elements have more than a family kinship, being all composed of the same electrons and protons, combined in dynamical groups of definite number and arrangement, the elucidation of which is largely due to Rutherford and his brilliant disciples Moseley and Bohr; though in 1894 the X-rays which have proved such a powerful instrument of research were not known. Radioactivity itself was not even in its infancy; neither X-rays nor radium had yet been discovered. Hertz, however, had discovered the electromagnetic waves in space, the mathematical

theory of which had been given, long before we knew how to produce them, by Clerk Maxwell; and the President takes the opportunity of expressing "the regret deeply and generally felt that death [the recent death of Hertz] should have terminated prematurely the scientific career which had begun with such brilliant promise and such fruitful achievements."

The Ether of Space.

Lord Salisbury goes on to pour a little good-natured scorn on the Ether of space, or, at any rate, on our notable ignorance of that body; an ignorance which time has hardly alleviated, and which has led some eminent and highly-qualified physicists to doubt its existence.

"The mystery of the ether (he says) though it has been made more fascinating by these discoveries, remains even more inscrutable than before. Of this all-pervading entity we know absolutely nothing except this one fact, that it can be made to undulate. Whether, outside the influence of matter on the motion of its waves, ether has any effect on matter or matter upon it, is absolutely unknown. And even its solitary function of undulating, ether performs in an abnormal fashion which has caused infinite perplexity."

He speaks of Lord Kelvin's attempt at a hydraulic or vortex theory of the ether, an attempt which has not in its original form survived, though some day there is a hope that it may in another form be resuscitated. It is, to this day, still not easy to reconcile the behaviour of the ether with dynamical law.

"The extended conception which enables us to recognize ethereal waves in the vibrations of electricity has added infinite attraction to the study of those waves, but it carries its own difficulties with it. It is not easy to fit in the theory of electrical ether waves with the phenomena of positive and negative electricity, and as to the true significance and cause of those counteracting and complementary forces, to which we give the provisional names of negative and positive, we know about as much now as Franklin knew a century and a half ago."

The world had not to wait very long—only three years more—before Sir J. J. Thomson discovered the electron; already he was determining the velocity of Crookes's cathode rays, an essential preliminary to that brilliant series of investigations which resulted in the discovery of the mass of the electron, thus giving to negative electricity a bodily and atomic form; while the in many respects more mysterious proton, or unit of positive electricity, followed some years later, and was found to be identical with the substratum of material mass—as Benjamin Franklin in his one-fluid theory had dimly surmised.

After that reference to the ether and its difficulties, Lord Salisbury went on to deal with biology and the work of Darwin, in a way which by no means pleased the biologists; upholding the doctrine of design, and the admitted facts of artificial selection, as against the rather random method of natural selection and the mere survival of favourable but unexplained variations. Incidentally, he touches upon the question of the age of the earth, a controversy between physicists, geologists, and biologists, which was then and for some time after raging, but the discussion of which has been entirely revolutionized, with a restoration of harmony, by the discovery of fresh and unexpected sources of heat, summed up under the general title of radioactivity. At that time no one would have imagined that the radiative energy of the stars was possibly to be explained in terms of the disappearance or mutual destruction of the very ingredients of matter.

Nearing his conclusion, the President once more emphasizes our ignorance on fundamental questions:—

"To the riddles which Nature propounds to us, the profession of ignorance must constantly be our only reasonable answer. A cloud of impenetrable mystery hangs over the development and still more over the origin of life. If we strain our eyes to pierce it, with the foregone conclusion that some solution is and must be attainable, we shall only mistake for discoveries the figments of our own imagination."

In spite of our progress in the last thirty years the general trend of these remarks remains mainly true. The boundary of our ignorance shifts from time to time as our knowledge slowly increases; but it is never obliterated, and we are still enshrouded by, if not an impenetrable, an as yet unpenetrated region of mystery.

Now, turning to the *Transactions* of Section A, the comprehensive and unsubdivided section concerned with the mathematical and physical sciences, over which in 1894 Professor Rücker presided, we find many contributions suggestive of progress in later years. For instance, Lord Kelvin and his assistants raised the question whether electricity can be generated by the subtraction of water from air, an inquiry which might have developed into the theory of thunderstorms so well worked out by the present Head of the Meteorological Department, Dr. G. C. Simpson; who has found that air and water are really electrified when raindrops are broken up by an ascending current of air, and that this strangely simple and really very curious cause is the origin of thunderstorms.

A Discussion on Flight.

A discussion on Flight was opened by Hiram S. Maxim, whose method of preliminary flying at that time took the form of a sort of locomotive running on rails, with an inclined plane which at a certain speed raised it from the ground by reaction against the air; thus bringing its guiding wheels into contact with an

upper rail, which was intended to prevent the flight from becoming extensive and dangerous. Passengers in this curiously lumbersome vehicle seem to have found the sensation of rising even a few inches from the ground exhilarating. The late Lord Rayleigh (who had worked mathematically at the elevating power of an air-plane, an essential feature in all flying mechanism), went on one of these trips, but was humorously urged not to risk his valuable life as ballast on so dangerous an expedition, but to send a copy of his works, which would be sufficiently heavy for the purpose. The remarkable progress made in the art of flying since then needs no comment.

Beautiful photographs of spiral nebulae were shown by Dr. Isaac Roberts, the spiral character of the Andromeda nebula having been thus recently discovered; and in his contribution the author claims:—(1) That the existence of spiral nebulae is a physical reality; (2) That the convolutions of the spirals proceed symmetrically from a centre,—which indeed is completely in accord with the powerful mathematical investigations of Dr. J. H. Jeans on the behaviour of an immense rotating mass of gas, and the consequent evolution of stellar systems.

Among other details I note:—Lord Rayleigh's quantitative theory of the telephone; Wilberforce's demonstration of the peculiar vibrations of a loaded spiral spring; A determination of the international ohm in absolute measure; Displacement of the rotational axis of the earth; A paper of mine on the early stages of photo-electricity, and another carrying on my work on the velocity of ions in electrolytes, and many other subjects which have considerably developed since, though still no method is known of determining the velocity of the ions in metallic conductors.*

Beginning of Radio Telegraphy.

But the editor has asked me to refer specially to the communication which I made, to a joint sectional meeting, in illustration of Clerk Maxwell's theory and the production and utilization of Hertzian waves, which is often referred to as the beginning of radio telegraphy. Certainly the demonstration excited great interest, and was made before a crowded audience in the large lecture theatre of the Oxford Museum. Among those present was the great mathematical physicist Ludwig Boltzmann, then Professor in an Austrian university.

I was chiefly interested in emphasizing the fundamental work of Clerk Maxwell and the brilliant experimental discoveries of the recently-deceased Heinrich Hertz. I am afraid I went beyond demonstration, saying that the waves ought to be called Maxwellian waves, and at the same time speaking of Hertz as "no ordinary German." Professor Boltzmann was moved to controvert both these statements. He rose and objected, with some warmth, to my manner of dealing with the great men of his nation; partly perhaps because he rather misunderstood the trend of what I was saying, and partly because I may have been led by comparatively youthful enthusiasm to speak in an insufficiently balanced and well-guarded manner. Comparisons are always objectionable; and the emphatic recognition of Hertz's work in this country had not been entirely pleasing to the older physicists of his own land. To most of them at that time Maxwell's theory was hardly known; they had their own theories and their own experiments. In letters to me Hertz sometimes referred to the difficulty which he had in getting his results understood by the orthodox professors of his own country; always excepting his quondam chief, von Helmholtz. And Boltzmann felt rather indignant at the picking out of one worker for special laudation. "For me," he said, in the course of his speech, "I am an ordinary German!" His meaning was clear enough, but his developed theory of the equipartition of energy, his work on the kinetic theory of gases, and the many other recondite researches for which he was famous, showed that Boltzmann was no ordinary man, whether of his own or any other nation; and I trust that the incipient conflagration was speedily damped down by an appreciative reply.

The wave experiments shown at that meeting were a development of those I had previously expanded, as a memorial to Hertz, two months earlier on 1st June in the theatre of the Royal Institution, London. Neither of these 1894 occasions was the one at which the wall-paper sparkled. That was five years earlier, in a lecture of mine on the Leyden jar in 1889.* The reflection, refraction, polarization, and other properties of the waves were demonstrated (in 1894) in what may now be considered the usual manner, the detection being accomplished, not by point coherer and telephone, as was the simplest plan in the laboratory, but by Branly's method with a tube of iron filings and a galvanometer. The possibility of actual signalling by this method was insisted on at Oxford; the iron filings being provided with a tapping back arrangement, which restored them to sensitiveness

* Many of these papers, including many not here referred to from lack of space, are briefly reported in *Nature*, vol. 50, pp. 406/409.

* See "Modern Views of Electricity," first edition, p. 401.

directly the wave had subsided; the potential collected from the wave having the power of increasing the conductivity of the filings enormously, while a mechanical tap reduced the tube to its previous high resistance.

The sending instrument was a Hertz vibrator actuated by an ordinary induction coil set in action by a Morse key. This apparatus was in another room, and was worked by an assistant.

The receiving apparatus was a filings tube in a copper hat, in circuit with a battery, actuating either a Morse recorder on a tape, or, for better demonstration, a Kelvin marine galvanometer, as first used for Atlantic telegraphy before the siphon recorder replaced it. The instrument was lent me by Dr. Alexander Muirhead, whose firm habitually constructed a number of cable instruments. The little mirror in this speaking galvanometer is enclosed in a flat box so constructed as to damp its motion rapidly by the viscosity of the contained air. Thus it responded to signals sharply, in a dead-beat manner, without confusing oscillations.

When the Morse key at the sending end was held down, the rapid trembler of the coil maintained the wave production, and the deflected spot of light at the receiving end remained in its deflected position so long as the key was down; but when the key was only momentarily depressed, a short series of waves was emitted, and the spot of light then suffered a momentary deflection. These long and short signals obviously corresponded to the dashes and dots of the Morse code; and thus it was easy to demonstrate the signalling of some letters of the alphabet, so that they could be read by any telegraphist in the audience—some of whom may even now remember that they did so.

Truly it was a very infantile kind of radio-telegraphy, but we found that distance was comparatively immaterial; and at Liverpool, where I was then working, the dots and dashes were received with ease across the quadrangle, or from any reasonable distance.

My often-quoted estimate of half a mile, as a possible distance, relates to earlier and still more primitive experiments, when the waves were produced by sparking to a sphere only about six inches in diameter; these short and highly damped waves, about nine inches long, giving remarkably powerful effects at the coherer in the detecting room of the laboratory, considering the smallness of the energy involved in their production. The fact is that a spark lasts so infinitesimal a time, less than the millionth of a second, that almost any energy when divided by the time gives a very large horse-power. A small Hertz radiator (two plates connected by a bar) emits energy, as I reckoned, at the rate of 100 horse-power; the radiant energy, other things being equal, varying inversely with the fourth power of the wave-length, in accordance with the theories of G. F. FitzGerald and Sir Joseph Larmor.

Hence I had hopes that by the use of short waves signalling across considerable distances of space could by this means be accomplished; and the late Lord Rayleigh urged me to take this matter up and develop it. I did not follow his advice, being fully occupied in teaching, and I had not the perceptive faculty shown about the same time by Sir William Crookes, who anticipated that such a method of telegraphy would be or might become of international importance.

How extraordinarily this incipient demonstration has been extended, remodelled, and altogether revolutionized, by the skill, energy, and enterprise of Senator Marconi and his co-workers, is known to the whole world. Real selective tuning became possible through my patent of 1897, and now the further development of the Fleming vacuum valve, which has made possible telephony or speech transmission, is known to every listener-in. Certainly it is a surprising development to have taken place in so comparatively short a time; and the perfection of the transmitters now in use by the B.B.C. casts unlimited credit on the engineers and physicists responsible for all these vast improvements.

The Discovery of Argon

Another fact which makes the 1894 Oxford meeting of the British Association memorable is that during that meeting the announcement of Lord Rayleigh's discovery of argon was made to the Chemical Section. The detection of a new gas as a constituent of the atmosphere was announced by Rayleigh and Ramsay, and was received with a good deal of scepticism. Some chemists doubted the discovery of a new gas altogether; while others denied that it was present in the atmosphere. But the statement that the air contained nearly one per cent of a non-oxidizable gas, heavier than nitrogen in the proportion 10 : 7, was quite true, and has been abundantly confirmed since. It was the first of the inert gases, of which Ramsay proceeded to discover the whole family; and argon became of fundamental importance as representing the first discovered member of a wholly overlooked column or keynote-series in the classification of the elements. All the members of this series possess a compact and self-satisfied constitution which has now been elaborated by the noble genius of Bohr.

Will any communication of equal moment be made to any section of the Association during the meeting in August, 1926?

Schliemann and Mycenae, 1876-1926.

By A. J. B. Wace, M.A.

This month marks the jubilee of the beginning of excavation at Mycenae by Heinrich Schliemann, the celebrated German archaeologist. His work yielded the first evidence of an historical foundation for Homer and the legends of the heroic age, which were until fifty years ago regarded as baseless fairy tales.

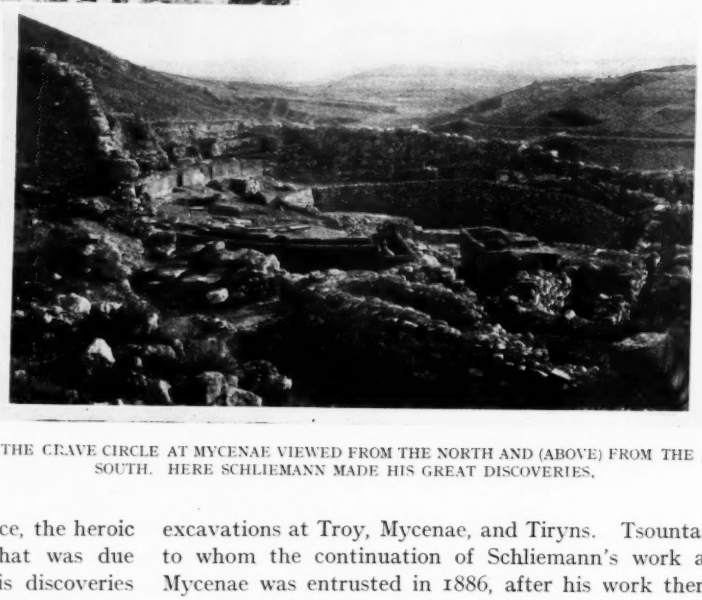
In August, 1876, fifty years ago, Schliemann began his excavations at Mycenae with this firm belief, "I know that, after Troy, I could not possibly render a greater service to science than by excavating at Mycenae." At Troy he had proved the existence of an important city on that site from a remote period, though it was too soon to see the full meaning of his discoveries. The first stratum we now know, and the second, which he thought the Troy of Priam, both belong to the early Bronze Age. It was only just before his death in 1890 that further patient work began to reveal the massive walls of the sixth stratum, which from his finds at Mycenae is clearly the Troy of Homer. The importance of his excavations can hardly be estimated nowadays when we have grown so accustomed to the wonders of Homeric and pre-Homeric Greece. When Schliemann began, the orthodox view was that Homer and the legends of the heroic age were baseless fairy tales. Schliemann's intuition saw clearly from his boyhood that poetry such as Homer in its simple grandeur and rich diction must rest on a basis of historical fact. He saw too that the advanced state of civilization described by Homer, and the very perfection of his language, implied that they were the heirs of a long period of human effort, that the culture, of which they present the climax, must have been gradually evolving for many long centuries before. Still, in spite of Homer, Troy was not a Greek site till the days of the newer Ilion which Alexander and his successors built as the ninth city upon the historic mound. But if the excavation of Troy was important for the Homeric question, the exploration of its rival Mycenae was equally necessary. So Schliemann devoted himself to this after his first successes at Troy.

MYCENAE, SEEN FROM THE SOUTH AT DAWN.

In 1874 he examined the ruins of Mycenae, and by trial shafts decided his plan of campaign. He was convinced that the graves of Agamemnon and his companions, of which Pausanias records the tradition, lay within the walls of the citadel, and his flair and his researches led him to dig on the terrace just within the Lion Gate. He began work here on 7th August, 1876, and continued almost to Christmas of the same year. He was extraordinarily successful, both as to material results in the richness and quantity of the objects found, and as to the scientific results, the full harvest of which has even now not yet been reaped. Within a double ring of standing slabs roofed with horizontal slabs he found five royal tombs, to which subsequent exploration added a sixth. These six graves contained the bodies of princes who, though not the house of Agamemnon, as Schliemann in his first enthusiasm claimed, reigned at Mycenae in the sixteenth century B.C., and were the contemporaries of the last of the Hyksos and of the earlier kings of the eighteenth dynasty. That we know so much about the history of the graves is due partly to new researches and partly to observations recorded by Schliemann during his excavations. Schliemann was not a trained excavator or a pottery expert in the modern sense—no one then was—but he did know the importance of potsherds and of recording the depth at which objects were found. He says, "nearly every object even to the fragments of pottery reveals a new page of history." His work was hastily done, his records are incomplete, and the objects found were not given the "first aid" now regarded as indispensable. Schliemann, however, was a pioneer; prehistoric archaeology, as far as Greece was concerned, did not then exist. He was the first, and if he had not the

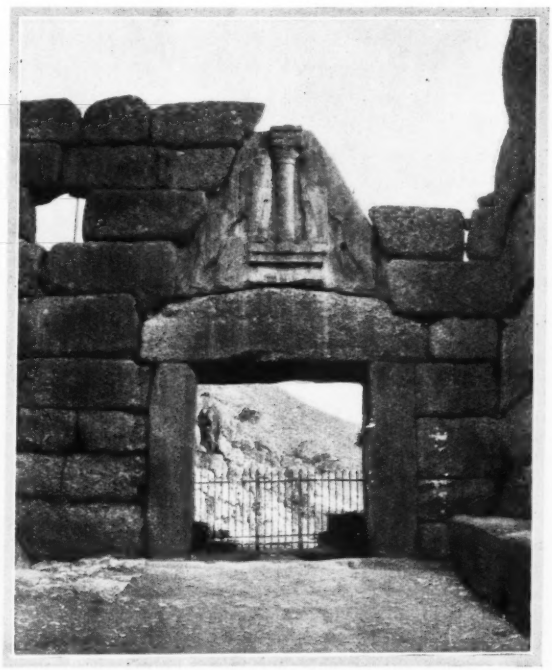
knowledge with which the work of fifty years has endowed us, he had many of the essential qualities of an archaeologist. He was patient, keen in observation, well-equipped with commonsense, and above all he had that intuition which is little short of genius. It is easy to criticize, but would the best of modern archaeologists have done better if equipped like Schliemann with only the same scanty experience?

Every excavation is destruction and inevitably destroys something which escapes record and can never be recovered. If Schliemann also destroyed some evidence which we can never recover, we owe him so much that we can forgive what he left undone. Now and then there comes a crisis in the advance of human knowledge when some great adventure must be undertaken to inspire others with faith to follow. Schliemann led the way when Greek archaeology was in its infancy, and no attempts to recover the history of Greece by excavation had been made. His genius divined and rediscovered the lost Bronze Age of Greece, the heroic age. If others were slow to follow, that was due partly to not understanding all that his discoveries involved, partly to classical conservatism. Schliemann showed that we can reconstruct lost history from archaeological facts and observations, especially from potsherds. His work at Mycenae was, of course, at first received with scepticism, just as his discoveries at Troy had been scornfully rejected. The treasures of Mycenae were Byzantine, or the plunder collected by Goths and buried in the graves of their chiefs! Even later, when he excavated Tiryns, the ruins there were condemned as Byzantine, and he and Dörpfeld had to defend them in debate in London. Slowly scholars came to realize that Schliemann had brought a new and an earlier aspect of the Greek world into their ken. Gladstone saw the value of his work for the Homeric question and the origins of Greek literature and civilization. Sir Charles Newton recognized that some vases from Rhodes, given to the British Museum by Ruskin many years before, and laid aside as unknown, belonged to the civilization found at Mycenae. In 1892 Professor Percy Gardner devoted three of his "New Chapters of Greek History" to the results of Schliemann's excavations at Troy, Mycenae, and Tiryns. Tsountas, to whom the continuation of Schliemann's work at Mycenae was entrusted in 1886, after his work there and in other parts of Greece, established in his "Mycenaean Age" the outlines of the earliest history and culture of Greece by co-ordinating the work of others with Schliemann's. Long before this Schliemann, who could not rest till he had gone to the root of the matter, divined that in Crete lay the



THE GRAVE CIRCLE AT MYCENAE VIEWED FROM THE NORTH AND (ABOVE) FROM THE SOUTH. HERE SCHLIEMANN MADE HIS GREAT DISCOVERIES.

origin of the splendours of Mycenae. He tried in vain to excavate at Knossos. Not till Crete was freed from Turkish rule could excavation begin there, ten years after Schliemann's death. The delay was probably an advantage, because by then the slow accumulation of knowledge gave to the fortunate excavators of Crete advantages such as Schliemann had never possessed. Since then Cretan explorers, Sir Arthur Evans, Halbherr, Chatsidakis, Xanthoudides and Seager, by the astonishing revelation of the wealth and power of Minos, have proved that Schliemann was right. Time has thus revenged him on those who denied the value and truth of his work. The rich results of the excavations of Knossos and other Cretan palaces which Schliemann almost foresaw are the climax to his work at Mycenae.

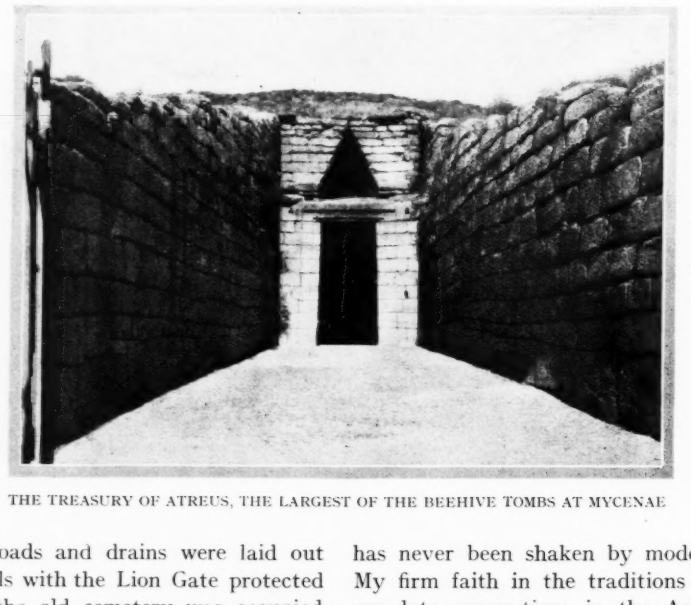


THE LION GATE, WHERE SCHLIEMANN BEGAN HIS WORK IN AUGUST, 1876.

Schliemann's work, supplemented by recent excavations, teaches us that Mycenae was first inhabited early in the Bronze Age, about the beginning of the third millennium B.C. There were sporadic settlements on the citadel and other hills near springs. In the Middle Bronze Age (from about 2000 B.C. to the end of the seventeenth century) the settlement on the citadel surpassed the others. The inhabitants were in touch with the Cyclades and Crete, and were closely akin to the islanders in culture, if not in race. They were possibly immigrants from the islands, who overran the greater part of southern Greece, subduing the neolithic folk, a branch of the people of Thessaly and the Upper Balkans. No trace of the Neolithic Age has yet been found at Mycenae though one of their villages was close by at the Argive Heraion. The Middle Bronze Age contains two cultural strains, one that of the Early Bronze Age, slowly advancing on the same lines as its kin in the Cyclades. The other is represented by fine wheel-made pottery of a curious grey or yellow-buff colour common in all south-eastern Greece, the source of which, though some have sought its origin in Thrace or Asia Minor, is still unknown. This new element mingled with the earlier folk, and was active and progressive. At the end of the seventeenth century came contact with Crete, and the brilliance of Minoan civilization reacted quickly on Mycenae. Under Cretan influence culture rapidly took a new form, aping the Minoan as early eighteenth-century Europe aped the Chinese. The Cretan wave did not submerge everything, and the mainland stock, too vigorous to endure complete suppression, still developed on its own lines. Then there arose at Mycenae a strong dynasty which lived on the summit of the citadel in a palace of which a few traces remain. Near where the Lion Gate now stands, a cemetery, used since the early second millennium B.C., occupied the lower hillside where the hard limestone gives way to a soft rock. It is the nearest place to the citadel where graves could be dug easily. The princes of the dynasty were laid here in six deep graves cut shaftwise in the rock, and here they were found by Schliemann in 1876, still lying with all their treasures around them. The nineteen or twenty bodies in the graves represent the dynasty which ruled Mycenae for the greater part of the sixteenth century. The date is shown by the pottery laid with them; their wealth by their gold, silver, and bronze; and all show the high level of their society and culture. Their treasures form, perhaps, the richest find from any excavation. There were great vessels and long swords of bronze which had hilts and scabbards of gold; cups of gold, silver and alabaster; rings of gold; necklaces of gold and amber; and gold discs which were sewn on their robes like embroidery. The life-like masks which covered the faces of the dead, and the bronze daggers inlaid with scenes in gold, a lion hunt or three magnificent lions galloping away, or cheetahs hunting ducks in a marsh, prove that those who served these princes

were craftsmen of no mean order. Such is the wealth and variety of these treasures that even to-day, after fifty years of study, a correct appreciation has not yet been attained. Only a few years ago there were put together the pieces of a silver libation vessel which is chased with a realistic siege scene, perhaps an exploit of its owner.

The Shaft Grave dynasty was succeeded about the end of the sixteenth century by another equally powerful which laid its dead in large beehive tombs built of stone in deep excavations in the hillsides. The Beehive Tomb dynasty flourished into the fourteenth century, and under a great king at the beginning of that century Mycenae, when Knossos fell, reached the zenith of prosperity. This king probably erected the Treasury of Atreus, the largest of the beehive tombs, for his sepulchre, as the pyramid builders in Egypt built each his own pyramid. This tomb in plan shows bold conception and deep knowledge of technical problems and in construction supreme engineering skill. The palace was rebuilt; the citadel enlarged; new houses, roads and drains were laid out and the cyclopean walls with the Lion Gate protected the whole. Part of the old cemetery was occupied by the Lion Gate, but the area of the royal graves was levelled, surrounded by the ring wall, and made into a sacred enclosure. The sanctity then attached to these royal tombs gave rise to the tradition preserved by Pausanias, and in due time led Schliemann to rediscover to the world the lost civilization of early Greece.



THE TREASURY OF ATREUS, THE LARGEST OF THE BEEHIVE TOMBS AT MYCENAE

The dominion of Mycenae collapsed in the twelfth century, not long after the traditional date for the Trojan War. Thus, though we cannot like Schliemann recognize the Shaft Grave princes as Agamemnon and his family, we can see the historical connexion between Homer, the Atridae, and the ruins of Mycenae. The latest decipherment of the archives of the Hittite kings, if correct, gives another side of the influence of the house of Atreus. It is one more piece of evidence that Schliemann was right in the broad outlines, that Homer gives a poetic version of historical facts, that Mycenae was the home of the King of Men whose power was felt on the coast of Asia Minor. Schliemann may not have been correct in his interpretation of all the details of his discoveries, but who are we with our little knowledge to depreciate him? It remains true that our advance of the last fifty years in the knowledge and study of Homer and Hellas, perhaps the greatest since the Renaissance, was inspired by Schliemann.

His inspiration was Homer, for he says, "The Trojan War has for a long time past been regarded by many eminent scholars as a myth. . . . But in all antiquity the siege and conquest of Ilium by the Greek army under Agamemnon was considered as an undoubted historical fact, and as such it is accepted by the great authority of Thucydides . . . For my part, I have always firmly believed in the Trojan War; my full faith in Homer and in the tradition has never been shaken by modern criticism . . . My firm faith in the traditions made me undertake my late excavations in the Acropolis (of Mycena), and led to the discovery of the five tombs, with their immense treasure."

Ross Institute for Tropical Diseases.

In opening the Ross Institute and Hospital for Tropical Diseases on 15th July, the Prince of Wales said he could think of no other single discovery in recent times which will earn the deep gratitude of so many thousands of human beings of all nationalities as the discovery made in India by Major Ronald Ross—as he was then—on 20th August, 1897. The institute was founded to commemorate the discovery of the method of transmission of malaria to human beings, with the object of undertaking research work in the prevention and treatment of tropical diseases.

The British Association for the Advancement of Science.

A Forecast of the Oxford Programme.

The following preliminary review of the papers to be read at the British Association's annual meeting this month at Oxford outlines the scope of the conference and discusses items of special interest in the programme.

THE British Association for the Advancement of Science will hold its ninety-sixth annual meeting at Oxford from 4-11th August. The presidential address of H.R.H. the Prince of Wales is expected to deal with some of the principal applications of scientific research to problems of imperial importance; and there are probably few members of the Association who have seen for themselves more numerous or impressive examples of this aspect of scientific work.

Public Lectures

In addition to the two formal discourses which are customary—delivered this year by Prof. A. S. Eddington on "Stars and Atoms," and by Prof. H. Fairfield Osborn on "Discoveries in the Gobi Desert, made on behalf of the American Museum of Natural History"—there will be public lectures for the citizens of Oxford by Sir Dugald Clark, Sir William Bragg, Professor P. F. Kendall, Capt. P. P. Eckersley, and Professor Julian Huxley, and a number of others in Abingdon, Witney, Swindon, and other towns in the neighbourhood; and also some children's lectures, of the kind which has been a very useful feature of recent meetings.

Among the sectional programmes special mention must be made of the "joint discussions" on current problems involving the co-operation of two or more sciences, which are usually arranged in advance, but sometimes arise, unforeseen, out of subjects of individual papers. The sections for physics and for chemistry will meet for discussion on the mechanism of homogeneous chemical reactions; zoology and physiology, on the value of tissue-culture in biology; zoology, anthropology and psychology, on heredity; geology, zoology and botany, on the conception of a species—in connexion wherewith should be noted Professor Fairfield Osborn's paper on the "Problem of the Origin of Species as it appeared to Darwin in 1859, and as it appears to-day." Similarly geography and anthropology discuss the effect on African native races of contacts with European civilization, a topic of the first importance to settlers and administrators at the present time; education and agriculture, the problems of educational training for overseas life, in which this year's President has already shown the keenest personal interest on previous occasions; and also on agricultural education, a peculiarly apposite topic in this essentially rural area. Less wide in scope, but involving the co-operation of several categories of workers, are the sectional discussions of integration and trigonometrical series, tautomerism, the problems of the Thames gravels, the technique and research methods of the geologist, the training of biologists, food transport with special reference to refrigeration, reflex-posture, vitamins, vegetative propagation, cultivation methods and soil classification in agriculture, and the feeding of dairy-cows. Such discussions are a special feature of the programme of the section for educational science, for it is not often that the teachers of all kinds of subjects can be brought together to review general problems of education from their respective points of view. The titles of these discussions are sufficient to show their range and interest—vocational selection, scholarships, the public-school system, the use of "wireless" and the cinematograph in education, the place of the history of science in education, and the recent advances in educational science generally.

The History of Research

In pursuance of an understanding between the sections most concerned, at last year's meeting, there will be a number of papers on the history of research, such as that of Professor G. W. O. Howe on the "History of Electricity and Magnetism"; of Professor C. H. Desch on the "History of Science as a link between the Sciences and Humanities"; of Dr. Gunther on the "Educational Value of the Lewis Evans Collection of Scientific Instruments" (recently acquired by the University and now admirably displayed in the upper rooms of the old Ashmolean building); and of Dr. Gunther, Dr. Hinks, Dr. E. Heawood, and Dr. Knox Shaw, on particular classes of early instruments, memorable observations, and the earlier Oxford collectors. The address of the President of the geological section, Professor S. H. Reynolds, will be a similar retrospect of the study of the British Lower Carboniferous Rocks.

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Other presidential addresses may be noted at this point. In mathematics and physics, Professor A. Fowler will deal with the "Analysis of Spectra," and his address will be followed by a discussion, in which it is expected that among others Professors Bohr, Ehrenfest, Runge, and Zeeman will speak. In chemistry, Professor J. F. Thorpe reviews the "Scope of Organic Chemistry"; in zoology, Professor J. Graham Kerr speaks on "Biology and the Training of the Citizen"; in geography, the Hon. W. Ormsby Gore discusses the "Economic Development of Africa and its effect on the Native Population," in the light of his recent tour of inspection as Under-Secretary of State for the Colonies; in economics, Sir Josiah Stamp gives as his subject "Inheritance as an Economic Factor"; in mechanical science, Sir John Snell traces the recent and probable future development of electricity supply; in anthropology, Professor H. J. Fleure deals with the "Regional Balance of Racial Evolution"; Professor J. B. Leathes, in physiology, will speak on "Function and Design"; and in psychology, Dr. J. Drever on the psychological aspects of our penal system. In botany, Dr. F. O. Bower, who supplies at very short notice the place vacated by the lamented death of Dr. W. Bateson, will compare the state of botanical science at the date of the two previous Oxford meetings, in 1860, and 1894, with its present position and outlook. Forestry, in view of the existence in Oxford of an important school of that subject, has this year a subsection of its own, instead of finding hospitality now with botany, now with agriculture; its president is Lord Clinton, whose services to the Board of Agriculture and the Forestry Commission are well known. In educational science, Sir Thomas Holland is President; and in agriculture Sir Daniel Hall, whose address on the limits of agricultural expansion will open a joint discussion between his own section and that of economics, in which Lord Bledisloe, Sir T. H. Middleton, Professor D. H. Macgregor, and W. R. J. Thomson are expected to join.

Corresponding Societies.

As usual, the Conference of Delegates of Corresponding Societies propounds for consideration one of the numerous lines of research in which the members of local scientific societies and field clubs necessarily are called on to do the great part of the preliminary observations. This year Sir John Russell will address the delegates on "Regional Survey," and explain the working of the strong committee on such surveys, of which he is chairman. The value and interest of these regional studies, and their stimulating effects as a part of an educational curriculum, are illustrated by such papers as those of W. W. Fitzgerald on the "Regional Significance of Manchester City and Port"; Mrs. H. Ormsby on the "Regional Survey of London," conducted by the London School of Economics; Mr. H. O. Beckit on the "Site and Growth of Oxford"; Miss Simpson on "Wychwood Village Sites"; and Miss Violet Butler on "Local Lore Surveys by Oxfordshire Schools," whose results will be collected in a small temporary exhibition.

Foreign visitors are expected to be unusually numerous. The American, French, Italian, Australian and South African Associations for the Advancement of Science will be represented by delegates, and several papers are already announced. Probably other guests will be found on arrival to have also brought contributions with them.

Congress at Stockholm.

There was at one time some fear lest the International Physiological Congress, which meets at Stockholm during the same week as the British Association, might draw off most of the British physiologists. But there has not actually been much difficulty in filling the sectional programme and, to judge from the titles, an interesting departure from custom has occurred, in the presentation of several papers in that department of applied physiology which lies on the frontiers of medicine. Examples are the papers of Dr. Hale Carpenter on "Some Problems connected with Sleeping-Sickness," and of Professor J. C. Drummond and others on "The Meaning of the Symptoms of Beri-beri." Probably it is the medical wing of the physiological contingent that is least able to indulge in distant excursions, even in the month of August.

Of really first-class novelties, it is difficult to discover much in the programme; but titles are often over-modest, and the last Oxford meeting, which is memorable for the announcement of wireless telegraphy by Sir Oliver Lodge, and the "pre-Phoenician script" of Minoan Crete by Sir Arthur Evans, did not show any better in advance than that of 1926. Mention may, however, already be made of Miss Garrod's discovery of what is thought to be a well-preserved "Neanderthal Man" at Gibraltar, whose remains have already arrived in Oxford, and it is hoped may be sufficiently coherent for exhibition.

In addition to the exhibit which has been so generally appreciated in recent years, of weather-recording apparatus and methods, by the Meteorological Office, there will be this year a demonstration of aircraft and aviation by the Royal Air Force. Some of the latest types of machines will be parked in Port Meadow for inspection, and there will be an exhibition of military flying on the Friday afternoon.

Insect Carriers of Plant Disease.

By Kenneth M. Smith, D.Sc.

Department of Entomology, the University, Manchester.

As a result of recent research interesting theories have been advanced to explain the mechanism of the spreading by insects of plant diseases, which are responsible for vast damage to crops.

In a recent number of *Discovery* an account was given of the spread of certain diseases of man by the agency of animals. It is the purpose of this article to describe an exactly parallel state of affairs in the plant world, *i.e.* the spread of certain infectious diseases from plant to plant, also by animals—in this case insects. The discovery that insects act as the "vehicles" or transmitting agents of many serious plant diseases gives an added importance to the question of insect control.

Some of these infectious disorders are known to be caused by an organism or germ, others such as the so-called "degeneration" or "virus" diseases of the potato and allied plants are presumed to be due to the presence of an organism of the ultra-microscopic, filter-passing type, but so far no such organism has been isolated.

The insect-borne diseases of plants may conveniently be divided into two classes: firstly that class in which the causal organism is thought to undergo some necessary phase of its development inside the body of the insect carrier, which in that case may be termed an "obligate alternate host," and secondly where the insect acts purely as the vehicle or "mechanical carrier" of the organism from plant to plant. It should be recognized that in the present state of our knowledge of this subject it cannot be stated definitely that the organism undergoes necessary changes inside the body of the insect host; it can only be deduced from circumstantial evidence.

A Parallel to Malaria.

The first class of insect-borne plant diseases can be best compared to malaria and its dissemination by the mosquito. Here, as is well known, only a certain type of mosquito (*Anopheles*) is able to transmit the malarial organism, presumably because other species of mosquito are not suitable for the development of the malarial organism. Some parallel cases in the plant world are suggested by the following examples. In America a serious disease of beet called "curly top" is spread by a small sucking insect known as a leaf-hopper which punctures the plant when feeding, and all attempts to spread curly top by the agency of other insects have failed. Similarly Storey* has shown that in the case of an infectious disease of maize known as "streak," the transmitting agent is also a small leaf-hopper (*Balclutha mbila*), and all efforts to induce other insects, even those of closely allied species, to carry the disease have proved unsuccessful. In "aster yellows," another infectious plant disease, Dr. Kunkel* has shown that the insect responsible for the dissemination of the disorder, a leaf-hopper (*Cicadula sexnotata*) does not become infective after feeding upon a diseased plant until a period varying from six to fourteen days has elapsed.

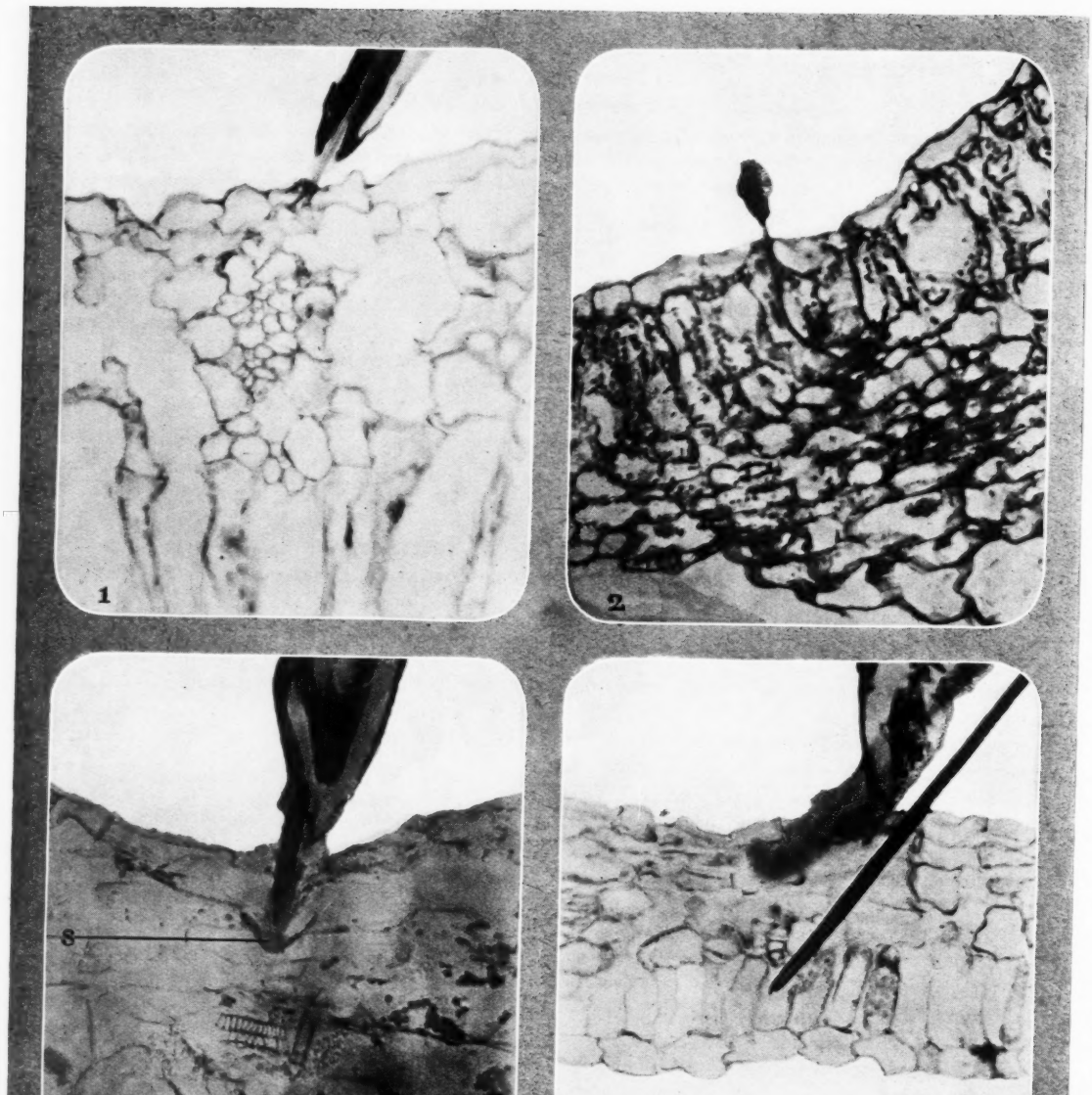
In these three diseases, then, it appears as if we had a parallel to the malaria of man, in that there seems to exist a definite relationship between plant, insect and organism, and that the organism depends upon a certain species of insect for the development of some necessary phase in its life history. It is a curious point that the insect carriers of both "curly top" and "aster yellows," having once transmitted the disease, seem never to lose their infective power.

Virus Diseases.

We come now to the consideration of a group of insect-transmitted diseases of plants of very great economic importance and which, until further research proves the contrary, must be placed in the second category, where the insects act as mechanical carriers. This group of disorders is known as "virus diseases" and includes the well-known "mosaic" which attacks plants of almost every order, but is perhaps best known in its relation to the potato. As already mentioned, the organism causing mosaic has not been isolated; in fact, it is not even known whether the disease is due to an organism at all, but at the moment it will be better to assume the existence of some possibly ultra-microscopic organism. A good deal of confusion still exists as to the actual insects responsible for the transmission of potato mosaic, but there seems to be no doubt that aphides or "greenfly" are chiefly concerned in the spread of the disease. Inoculation experiments are now in progress to determine what others of the insect fauna of the potato plant may be potential carriers of mosaic. There is no question that virus diseases of the potato,

* Storey, H. H., *Ann. App. Biology*, vol. xii, No. 4.

*Kunkel, L. O., *Phytopathology*, vol. 16, No. 1, 1926.



PHOTOMICROGRAPHS ILLUSTRATING RELATION OF INSECTS' FEEDING TO THE SPREAD OF PLANT DISEASE.

Figs. 1 and 2 show how the green-fly is thought to infect the potato plant with disease by feeding on the phloem of the leaf, a region rich in albuminous matter. In Figs. 3 and 4, the leaf-hopper is seen feeding on the same leaf but in a slightly different area. Both insects are believed to carry the disease in their saliva (seen at S in Fig. 3), but much depends on what cells are contaminated by this saliva. (Details described in accompanying text. Magnification: Figs. 1, 3, 4 by 800; Fig. 2 by 650.)

including mosaic and the allied disorder of leaf-roll, are becoming an increasing menace to the potato-growing industry of the world, and the problem of the control of these diseases is intimately bound up with the control of the insects concerned in their dissemination.

In considering how the insect infects the plant we must revert to the malaria parallel. Just as the mosquito when sucking its victim's blood contaminates it with the malarial organism, so presumably does the aphis when sucking the sap of the plant contaminate it with the virus of mosaic disease. On account of the importance which now attaches to potato insects considerable attention has been paid to the methods of feeding of these creatures and the effect such feeding has upon the tissues of the host, in the hope of thereby discovering something further of the mechanics of inoculation with virus disease.

The aphis and all plant-sucking insects possess a long beak or proboscis in which slide two pairs of grooved needles (mandibles and maxillae) the apposition of which forms two canals. When these needles are inserted into the plant tissue, the sap is sucked up one canal, while the insect's saliva flows down the other. It is this salivary secretion which is suspected of carrying the disease germs to the plant.

Infection of the Potato Plant.

Let us suppose that a green-fly or leaf-hopper after feeding upon a virus-infected potato plant seeks " fresh fields and pastures new " in the form of healthy potato plants. Here the beak is pressed into the new host and the saliva contaminated with the virus from the previous infected plant pours down its channel into the tissues of the healthy plant.

That, so far as we know, is the method by which the insect infects a healthy plant. The matter, however, is not so simple as it appears, and there are still many important points concerning these insect carriers upon which more information is required. Why, for instance, should not all the plant bugs which attack the potato plant carry the disease instead of only certain species, especially if, as we suppose, they act merely as mechanical carriers of the virus ? The answer to this question may lie perhaps in the exact method of the insect's feeding, *i.e.*, what part of the plant tissue does it seek out and contaminate with its sucking beak ?

We know that aphides, the most frequent carriers of this disease, habitually seek out the phloem region of the vascular bundles which are the conducting tracts of the plant. The phloem happens also to be an excellent place for the multiplication of a possible germ and also for its distribution about the plant. We might postulate then that insects which suck the phloem are the most likely transmitters of this disease. How the sucking insect reaches this region is best illustrated by means of a picture.

Details of the Illustrations.

In the photomicrograph (Fig. 1) may be seen an aphis about to penetrate a potato leaf by way of a stoma (aerating structure) and seek out the phloem which can be seen lying just below. Fig. 2 illustrates a later stage in this process where the beak has now reached its objective. Note how the beak has turned in the tissue to reach the phloem. The magnification in Fig. 2 is somewhat less than that of Fig. 1.

Let us now consider how another common potato insect feeds, and see if according to our theory it also can carry virus disease. This is a small black and yellow insect, a leaf-hopper (*Eupteryx auratus*) which is frequently to be found upon the potato foliage. Fig. 3 shows this insect in the act of making for the vascular bundle ; a drop of the all-important saliva can be seen (S) at the tip of the beak. In the last photograph (Fig. 4) the same insect can be seen sucking, not the vascular bundles this time, but the palisade cells. Note the empty sucked-out cells, and how in this instance the insect has passed by the vascular bundle which lies a little to the left of the sucking organ. The canal down which the saliva passes into the plant is plainly shown in the photograph.

It must be understood that the supposition that phloem-feeding insects are the ones which most successfully inoculate mosaic disease is only a theory, and is suggested as a possible explanation of the fact that certain species can act as " disease vehicles " and others cannot. This theory may break down when research throws further light upon the conditions pertaining to successful disease inoculation by insects.

There remains a great deal of investigation still to be carried out : we know nothing of what may be the respective conditions of plant and insect necessary to achieve successful inoculation, and very little concerning the effects of temperature, light and humidity upon these diseases.

The first step, however, from the entomologist's point of view must be the identification of the actual insect-carriers of disease, and when that is accomplished, control measures against them will have to be further developed.

In conclusion the writer wishes to acknowledge his indebtedness to the editors of the *Annals of Applied Biology* for permission to reproduce some of the illustrations from his recent paper in that journal.*.

* Smith, K. M., *Ann. App. Biology* vol. xiii, No. 1, 1926.

Charles I and the Stigma of the Glamorgan Commission.

By C. Ainsworth Mitchell, M.A.

New light on the problem of the Glamorgan Commission and its stigma on Charles I is forthcoming from the discovery a few months ago of a document which appears to be the royal warrant that has long been missing.

FEW events in history have given rise to more controversy than those connected with the Commission given to the Earl of Glamorgan by Charles I to enlist Irish support in his struggle with the Parliamentary forces, in exchange for religious concessions. Some historians would not admit that there was a secret Commission; others, like Hume, regarded it as a perfectly innocent transaction which had been misrepresented as a stain on the memory of Charles; and others again, like Lingard, pointed to it as a proof of the King's duplicity and treachery.

Until a few months ago the principal original document, upon which much depends, was believed to have been lost. It was once in the possession of Lingard (1771-1851), who is known to have lent it to Canon Tierney (d. 1862), who bequeathed his MSS. to Thomas Grant, Roman Catholic Bishop of Southwark (d. 1870); but Gardiner, writing in 1887 (*Hist. Review*, ii, 698) stated that he had been unable to discover what had become of it. The present writer has been more fortunate, and thanks to a clue kindly given to him by Dr. Roche, Archivist of Southwark Cathedral, discovered that it was one of a parcel of unexamined documents returned last year from Southwark to Ushaw College, Durham. He would like to thank the authorities of that college for the facilities given by them for photographing and studying it and its companion warrant, "the further authority"; also Mr. Edis of Durham for his skilful photographic reproduction of these documents.

At the time of this Commission the civil war between the Royalists and the Parliamentary forces had lasted some three years, and, though there had been fluctuating successes, there had been as yet no decisive victory on either side. By the beginning of 1645 Charles, who had established his court at Oxford, was finding it increasingly difficult to raise fresh men for his armies, and so was driven to consent to a plan which, as he was well aware, would be hateful not only to his opponents but also to many of his leading supporters.

The insurrection against the English rule in Ireland, which had broken out in 1641, had been temporarily stopped in 1643 by a truce between the Marquess of Ormond, representing the King, and the Irish Council of Kilkenny. This enabled Ormond to send a large proportion of the English troops who had been fighting in Ireland to the assistance of the King, and although no further supplies could be looked for from that source, there still remained the possibility of making a definite peace with the Irish and of obtaining the needed military help from them.

One has only to recall the bitter fanaticism which characterized the struggle between the Cavaliers and Roundheads to realize what the effect upon the Puritan mind would have been of a scheme to import into England some thousands of lawless men, not only professing a hated religion, but also universally believed to be guilty of unspeakable outrages upon English Protestants.

Delicate Negotiations.

It was necessary, therefore, for Charles to move secretly if he was to avoid straining the loyalty of his own Protestant supporters. The Marquess of Ormond was in favour of the plan, but for its delicate negotiation some one was needed who was not only loyal to the King, but who would also be accepted by the Irish Catholics as favourable to their religion, and Lord Edward Herbert, the second son of the Marquess of Worcester, was chosen as the most suitable person. He belonged to one of the old English Catholic families, and his father had given practical proof of his devotion to the cause of the King by spending over £200,000 to further it.

On 2nd January, 1645, Lord Herbert, who had not yet been created Earl of Glamorgan, received his instructions from the King in the following terms:—

"You may engage your estate, interest and credit that we will most readily and punctually perform any of our promises to the Irish, and as it is necessary to conclude peace suddenly, soe whatsoever shall be consented unto by our lieutenant the Marquis Ormond, we will dye a thousand deaths rather than disannull or break it; and if upon necessity anything be to be condescended unto, and yet the lord marquis not willing to be seen therein, as not fitt for us publickly to owne, do you endeavour to supply the same." (Lingard, VIII, p. 306).

On 12th March the King wrote a letter in which he expresses surprise that Glamorgan has not already left for Ireland, and repeats his pledges:—

"On the word of a King and a Christian I will make good anything which our lieutenant shall be induced unto upon your persuasion; and if you find it fitting you may privately

show him these, which I intend not as obligatory to him but to myself." (Lingard, VIII, p. 307.)

The word "these" in this letter probably refers to the official warrant, which bears the same date, 12th March, 1644 (or 1645 according to modern reckoning). This is the missing document mentioned above, and a reproduction of it is given in Fig. 1. It runs as follows :—

"Charles R.—Charles of the Grace of God King of England Scotland France and Ireland Defendor of the Fayth etc. To our trusty and right well beloved Cosin Edward Earle of Glamorgan Greetings. We reposing great and espetiall trust and confidence in y^r^ approved Wisdome and fidelity doe by these (as firmely as under our great seale to all intents and purposes) Authorise and give you power to treate and conclude w^th^ the Confederat Romaine Catholikes in our Kingdome of Ireland, if upon necessity anything be to be condescended unto wherein our Lieutenant can not so well be seene in as not fitt for us at the present publickely to owne, and therefore we charge you to proceede according to this our Warrant w^th^ all possible secresie, and for whatsoever you shall engage yourself upon such valuable considerations as you in y^r^ judgement shall deeme fitt, we promise in the worde of a King and a Christian to ratifie and performe the same, that shall be graunted by you, and under your hand and seale, the sayd Catholikes having by theyr supplyes testified theyr zeale to our service, and this shall be in eache particular to you a sufficient warrant Given at our Court at Oxford under our signett and Royall signature the twelfe day of Marche in the twentieth yeare of our Raigne 1644—To our Right Trusty and right wellbeloved Cosin Edward Earle of Glamorgan."

The Secret Treaty.

Armed with this authority Glamorgan hastened to Kilkenny, and very soon made a secret treaty with the Irish Council granting religious concessions to the Catholics, in return for which they were to provide a force of 10,000 men for the King and contribute two-thirds of their ecclesiastical revenues to help his cause during the war. The negotiations for the more public treaty were also continued, with Glamorgan as intermediary.

In the meantime Glamorgan's secret treaty had become known to the English Parliament. The Catholic Archbishop Michael Kelly of Tuam had been killed during a sortie of the garrison of Sligo under Sir John Coote, and a copy of the treaty which had been found among his papers had been sent over to England and promptly published. It created a great sensation, and was used as evidence that the King had been betraying the country to the Pope. A copy of the document was sent to Ormond, who disclaimed all knowledge of it and, with the consent of the King, caused Glamorgan to be arrested on a charge of treason for exceeding his authority. Lingard (VIII, p. 58) asserts that this arrest was merely a blind, intended to shield the King.

Glamorgan, when challenged to produce his authority for his secret treaty, alleged that it had been left with the Irish Council at Kilkenny, but on being pressed he produced a document which he described as his "further authority." He made a copy of this "in his own hand" to which he signed his name, but expressed the hope that Ormond would not make any use of it except for his own private satisfaction. The Lord Lieutenant, however, thought it his duty to send a copy to the King, who asserted that he had no recollection of signing any such warrant (Carte, I, p. 554).

Repudiation by the King.

He also made a formal repudiation of any responsibility for Glamorgan's secret treaty, and in a message to the English Houses of Parliament he protested that the Earl of Glamorgan had no such commission.

Also, in a private letter to Ormond in which he could have had no object for lying, he solemnly protests that he had never intended that Glamorgan should act alone, and he refers to a warning which he had given in a ciphered postscript to a former letter (Carte, II, App. XXIII), of which Carte gives the interpretation as follows :—His honesty or affection to my service will not deceive you but I will not answer for his judgment (II, App. No. XIII). There is also a significant letter written on 3rd February, 1646, in which Charles reproaches Glamorgan for exceeding his instructions.

After his arrest Glamorgan produced a document described as a "defeazance" which, he stated, had been accepted by the Irish Council ; this is regarded by Hume as practically a demonstration that Glamorgan recognized that he had no power to conclude the treaty. It is to the effect that the Earl would do his utmost to induce the King to agree to the terms, but that, should he fail, he was not to be held liable.

Lingard's view of this secret stipulation is that it was a precaution taken by Glamorgan to leave the King a loophole for his withdrawal, should it prove necessary (p. 62). At all events, it secured the release of Glamorgan, and he returned to Kilkenny, with the approval of Ormond, to continue the negotiations with the Irish Council.

A new provisional treaty was drawn up, and arrangements were made to send 6,000 men at once to the relief of Chester, but before they could be shipped news came of the surrender of that town to the parliamentary forces. Glamorgan then attempted to arrange for other military expeditions, but the difficulties of landing the troops in England proved insuperable, and the whole scheme of providing

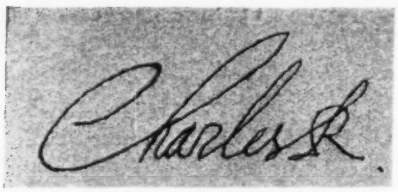


FIG. 2. AUTHENTIC SIGNATURE OF CHARLES I.

Irish reinforcements for the King's army was abandoned as hopeless.

When one studies the records of these tortuous negotiations it becomes obvious that the accusation against Charles I can be narrowed down to a simple issue. There can be no doubt that he attempted to bring over "the murderous Irish papists" as the parliamentarians labelled them, nor that many of his leading supporters accepted this course as an unpalatable necessity. Equally there can be no dispute as to the fact that the King was prepared to make far-reaching concessions to the Irish Roman Catholics to gain their help, or that Ormond and his other advisers agreed that such concessions must be temporarily kept secret, lest they should alienate Protestant supporters of the royal cause. But these actions, although imputed to the King as crimes by his opponents, do not reflect upon his personal honour. The gravamen of the charge against Charles was that he had given secret instructions to Glamorgan, authorizing him to make arrangements with the Irish Catholics behind the back of the Lord Lieutenant, and that afterwards he had repudiated his undertaking and had disavowed Glamorgan. It thus becomes a question whether the King or Glamorgan was speaking the truth.

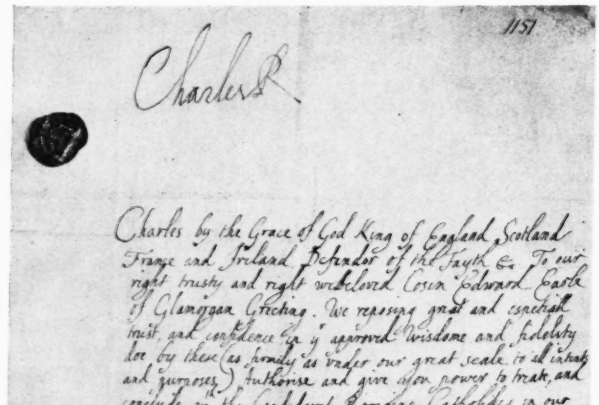


FIG. 1.
THE NEWLY-DISCOVERED DOCUMENT BELIEVED TO BE THE WARRANT GRANTED BY CHARLES I TO THE EARL OF GLAMORGAN.
The royal signature agrees closely with the admittedly authentic writing in Fig. 2.

An examination of Glamorgan's warrant of 12th March (Fig. 1) shows that there can be no reason for doubting its authenticity. It is a document of four pages, measuring 11⅜ inches by 7⅜ inches, and bears the endorsement "The Earle of Glamorgan's espetial warrant for Ireland." The writing is presumably that of one of the royal secretaries, and only the signature "Charles R" is here of importance. This signature agrees closely with the writing of Charles I, as may be seen by comparing it with an admittedly genuine signature of the King (Fig. 2). In both instances the mode of forming the letters and the relative heights of the letters are closely similar, and in both a want of firmness in the strokes and breaks in the continuity of the lines may be seen. Any suggestions that the letters have been retouched, as is often to be seen in traced signatures (*e.g.*, at the top of the "C" and "h" in the two signatures), may be discounted, since irregularity of line is a characteristic common to both specimens. There is also nothing suspicious about the royal seal below the King's signature.

The fact that the writing does not show any abnormal characteristics is a point of some interest in view of the widespread publicity which the genius of Shorthouse gained for his view that Charles I repudiated his signature in the Glamorgan transaction. One of the most dramatic incidents in historical fiction is the scene in which "John Inglesant," a fictitious messenger from Glamorgan to Lord Biron, then besieged in Chester by the parliamentary forces,

denies that his warrant had been signed by the King. A parliamentary lawyer to whom the document is submitted for an opinion upon the writing, declares the signature to be a palpable forgery, and Shorthouse adds that some of the letters were, in fact, unusually formed either by design or unintentionally. It is questionable how, far it is justifiable for an historical novelist to add realism to his narrative by the invention of such material details unless they agree with the facts.

In this instance the facts do not support the fiction, although, of course, it is most improbable that Shorthouse ever had the opportunity of checking the data for his romance by reference to this Glamorgan warrant.

The other Glamorgan document, which is also at Ushaw College, is endorsed "The Earle of Glamorgan's further authority." Like its companion, it has four pages ($12\frac{3}{8}$ inches by $7\frac{3}{4}$ inches), but does not bear the royal seal. It is dated 12th January, 1644, and runs as follows:—

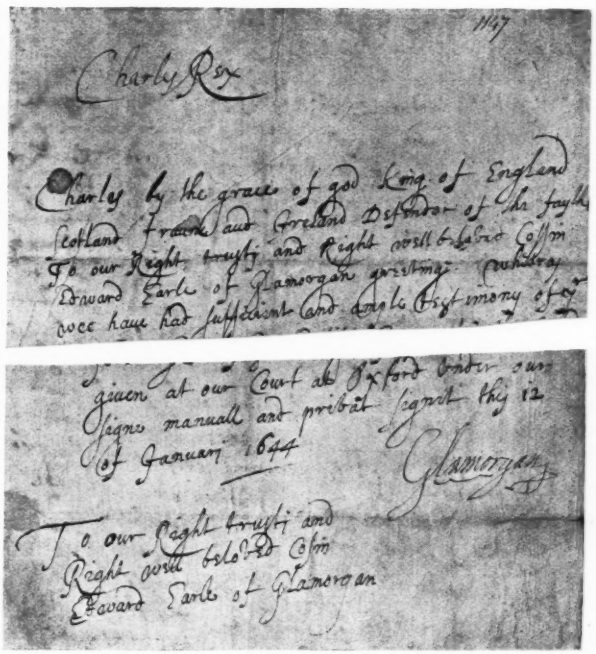


FIG. 3.
"THE EARL OF GLAMORGAN'S FURTHER AUTHORITY."
Beginning and ending parts of document bearing Glamorgan's signature (*cp.* Fig. 4), but not endorsed by the King (*cp.* signature with Fig. 2). The Royal Seal is absent.

"Charles Rex

Charles by the Grace of God King of England Scotland France and Ireland Defendor of the fayth. To our Right trusty and Right well beloved Cossin Edward Earle of Glamorgan greeting. Whereas wee have had sufficient and ample testimony of yr approved wisdome and fidelité Soe great is the Confidence wee repose in yow as that whatsoever yow shall performe as warranted only under our signe manuall pocket signett or privat marke or even by worde of mouth without further ceremony wee do in the woorde of a Kinge and a Christian promise to make good to all intents and purposes as effectually as if your authority from us had binne under our great seale of England wth this advantage that wee shall esteem our self farr the more obliged to yow for yor gallantry in not standing upon such nice terms to do us service wch wee shall god willing rewarde. And although yow exceed what law can warrant or any power of ours reach unto, yet it being for our service wee oblige our self not only to give yow our pardon but to mantayne the same wth all our might and power and though either by accident yow loose or by any other occasion yow shall deem necessary to deposite any of our warrants and so wante them at yor returne, we faythfully promise to make them good at your returne, and to supply any thinge wherein they shall be found defective, it not being convenient for us at this time to dispute upon them, for what we have here sett downe yow may rest confident, if there be fayth or truth in man, proceed therefor cheefully, spedely and bouldly, and for yor so doinge this shall be yor sufficient warrant given at our Court at Oxford under our signe manuall and privat signet this 12 of January 1644.

To our Right trusty and
Right well beloved Cosin
Edward Earle of Glamorgan."

The opening and ending passages of this unlimited authority to Glamorgan are shown in Fig. 3. The signature at the top is not that of Charles I, but its writing agrees with that of the body of the document. This was not written by the same person who wrote the body of the warrant of 12th March (Fig. 1). At the end of the document on the right-hand side is the signature "Glamorgan," the ink of which has faded to a different colour from that of the rest of the document, and was therefore, presumably, not written with the same ink. The writing of this endorsement agrees with that of the admitted writing of the Earl of Glamorgan (Fig. 4), and it is therefore reasonable to assume that this document was at one time in his possession.

In any case it is not an original warrant for, as mentioned above, the signature is not that of the King, nor is the seal referred to in the text to be found on the document.

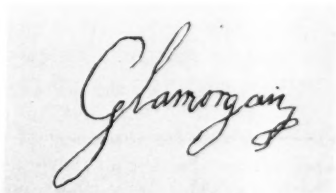


FIG. 4.
EARL OF GLAMORGAN'S SIGNATURE

Gardiner (*loc. cit.*, p. 698) suggests that this warrant had nothing

whatever to do with the Irish negotiations, but refers to separate financial arrangements to be made with the Pope and Catholic princes. This does not agree, however, with Carte's circumstantial narrative (Vol. I, p. 554), that the document was in fact produced by Glamorgan to Ormond (*vide supra*), although incidentally it may be mentioned that the writing of the text is not that of Glamorgan, and that this cannot therefore be the copy which Carte states that Glamorgan made "in his own hand," assuming that Carte was not mistaken on this point.

If the document could be accepted as an authentic copy of a genuine warrant to Glamorgan to undertake negotiations with the Irish, it would go far to prove the charge brought against the King. There are, however, a number of reasons against accepting it as an authentic copy. For instance, it was the King's custom to make his signature as "Charles R," as may be seen in the numerous letters published by Carte, and the use of the form "Charles Rex" would be most abnormal, especially upon such a formal document (Figs. 1 and 2).

One would not look for the royal seal upon a copy, but Carte (*loc. cit.*) tells us that the seal was also missing on the original produced by Glamorgan to Ormond.

Then there is the difficulty of the endorsement, "The further authority." This warrant is dated 12th January, whereas the main authority for the Irish negotiations, which one must accept as genuine, is dated 12th March. But the terms of the January warrant are so comprehensive that it would have been absurd to supplement them by a much weaker authority two months later.

Further, there is the allusion to Glamorgan as the Earl of Glamorgan, although the patent for the earldom was not granted until later and the King's letters to him during January refer to him as "Lord Herbert."

There is nothing in the letters before or after the date of this warrant to suggest that Charles regretted having given such extensive powers to his intermediary, and that the later warrant was intended to supersede the former. Indeed, the tendency of the whole correspondence from January to March goes to show that Glamorgan was expected to subordinate his judgment to that of Ormond, and this is also implied in the warrant of 12th March.

In view of the private opinion which Charles held of the discretion of Glamorgan and of the decided way in which he expressed it to Ormond (*supra*), it seems improbable that he would have put himself so completely in the power of a man of whose judgment he had formed so low an estimate when a much less committal authority would have served his purpose equally well.

Until these various inconsistencies have been reconciled or until an indubitable original is discovered this document, bearing Glamorgan's signature but repudiated by the King, cannot be accepted as the copy of an authentic warrant or regarded as valid evidence against the honour of Charles I.

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Reception at Bouverie House.

In connexion with the opening of Bouverie House, the new Fleet Street offices of *Discovery* and associated publications, a reception was held on Thursday, 15th July, by Sir Ernest Benn, for Messrs. Ernest Benn Ltd., and *Discovery*. The guests were received in the publications hall, a large panelled room lined with bookcases, and a recital by Miss Jelly d'Aranyi and Miss Myra Hess was given during the evening.

The Trustees of *Discovery* were represented by Sir Frederick Kenyon, and among those who accepted invitations were :—

Professor Henry Armstrong, Professor and Mrs. E. N. da C. Andrade, Mr. and Mrs. R. D. Blumenfeld, Mr. and Mrs. Campbell Jones, Sir Robert and Lady Donald, Mr. Walter De la Mare, Mr. E. N. Fallaize, Mr. and Mrs. H. A. L. Fisher, Professor Fraser Harris, Mr. and Mrs. Philip Guedalla, Sir Richard Gregory, Sir Israel and Lady Gollancz, Mr. and Mrs. G. P. Gooch, Dr. and Mrs. T. E. Gregory, Sir Frank and Lady Heath, Major Gordon Home, Mr. and Mrs. J. A. Hobson, Dr. P. Hall Smith, Lady Kenyon and the Misses Kenyon, Mr. C. Maleson, Dr. and Mrs. Stephen Miall, Sir William and Lady McCormick, Dr. C. S. Myers, Mr. and Mrs. Nigel Playfair, Sir William and Lady Perring, Professor T. H. Pear, Sir George Paish, Sir Alexander and Lady Roger, Dr. William Rose, Sir Charles Starmer, Mr. and Mrs. St. John Ervine, Mr. J. C. Squire, Sir Lawrence and Lady Weaver, Sir Tudor and Lady Walters, Mr. A. J. B. Wace, Mr. R. C. S. Walters, and Sir Alfred Yarrow.

A Bird Census of Kensington Gardens.

By E. M. Nicholson.

Author of "Birds in England."

It has lately been found that territory is a more vital factor in bird-life than was previously suspected. While counts of particular birds have at times been made in this country, one of the first comprehensive censuses was undertaken last winter by the author, who discusses the significance and possibilities of this new research.

In America the idea of taking a bird census has experimentally been put into practice; in England, where the greater variety of the landscape in small areas would give more interesting results, little or no substantial work of this kind has so far been undertaken. Yet the researches and observations of Mr. Eliot Howard and others have lately made it clear that territory is a more vital factor in bird life than has before been suspected. The insectivorous birds, at any rate, have been shown to occupy during the breeding season a considerable patch of ground for each pair from which all others of the same species are jealously excluded. Without such a system it would often happen that twenty broods of insatiable nestlings would hatch out simultaneously on an area incapable of supporting more than ten, with the result that all would be undernourished or perhaps starved. There would be nothing to secure the separation of nests by a sufficient distance. The value of a bird census in providing data for further investigation of the part played by territory needs no further emphasis.

Special Bird Counts.

Eliot Howard and Chance in Worcestershire, and Burkitt in Ireland, have undertaken intensive studies of small areas with a definite object in view—Chance's was incidental to a study of cuckoos and Burkitt has confined himself to the robin—while Alexander at Tunbridge Wells carried out a plan of mapping nesting areas but limited the scope to summer migrants. Thus while the subject has several times been touched upon incidentally it seems never, in this country, to have been tackled without prejudice; the taking of a bird census upon an adequate scale is a work that still remains undone.

During the winter of 1925-26 I took, with the help of my brother, a complete census of the birds of Kensington Gardens. It is far from being a normal area, and if it can be termed representative at all it is representative only of a very small fraction of the land surface of Great Britain. But for census purposes it has some rare advantages. Except on the east, where Hyde Park touches it, it is practically an island in a sea of houses. Its bird life is distinct and isolated, not confused by passers-by from an adjoining countryside. It is also a place where feeding by man is carried out on an enormous scale—so regularly and in such quantities that a great part of the bird population is dependent on it, and consequently very approachable.

The Plan of Campaign.

The general idea was to repeat the count at intervals of about a month, with a view to ascertaining the losses sustained during the winter months and how far these were caused directly by severe weather. Owing to unexpected difficulties and the fact that no appreciable change seemed to have taken place the February count was abandoned, but at the opening of November, December, January and March a census was successfully taken. The first census was made on the 2nd and 4th November, 1925. It might have been possible to complete it in one day, but the working time (even with two observers) was nine hours without allowing for rests, and the amount of walking involved was altogether incredible. That was, therefore, scarcely practicable and certainly not desirable, seeing that it would have meant prolonging the count into the hours when disturbing movements to or from the roost are in progress.

It will be as well at this point to deal with the subject of accuracy. The obvious question is: How do you know that the same birds were not counted two or more times, or that some by a simple flight did not escape the census altogether? The answer to that must be that a bird census cannot in any case claim the same degree of accuracy as a human census in a highly-organized country like Great Britain. All that can be done is to observe very carefully beforehand what considerable movements take place in the course of the day—an example from the Gardens is the concentration of sparrows in the late morning and afternoon around the Fountains and Peter Pan—and take them into consideration, so that if the area which loses birds is counted before the movement, that which gains is counted also before any movement takes place and not after, when many would be included twice. These are precautions of commonsense, but after they have all been taken there is

still some coming and going of birds across the arbitrary boundaries. It has therefore to be assumed that movements are of two kinds: general ones taking place at regular times, which are known and provided against, and fortuitous comings and goings (not affecting a very high proportion of the bird population) which roughly cancel one another out. Here there is one possible source of error, for if by any chance there is an unexpected general movement—an unlikely contingency, fortunately, if the preliminary observation has been thorough—it is impossible to cope with it. Another, obviously, lurks in the mere process of counting. It would be extravagant to claim that not a starling or a woodpigeon in the treetops, let alone a sparrow in the shrubberies, has been overlooked. But practice attains in a method which appears difficult and unlikely to be trustworthy an unexpected degree of accuracy: another example of this is the well-known skill of the Australian sheep-counter. The number of birds supposed to be occasional visitors to the gardens—kestrel, redwing, coal tit, pied woodpecker and others—unearthed in the course of the census was an indication of the efficiency of the search.

Limit of Error.

I do not, therefore, claim that the census figures as a whole are without a possible error of up to twenty per cent, although I personally am convinced that they represent within ten per cent, and in the case of the two complete counts within five per cent, the exact population as it was at the times stated. The more nearly instantaneously a census could be carried out the less danger of error could arise, but to complete even so small an area as Kensington Gardens within an hour would require at least sixteen thoroughly competent observers. Fluctuations may be very rapid—three consecutive counts at the Round Pond gave the number of gulls present as 170, 155, and 215 within a very few minutes—and even in an hour there would be at least a theoretical possibility of confusion; the advantage of such a number of observers would lie less in the speed of counting than in the fact that it could be repeated three or four times in one day. If the results then showed any serious discrepancies the fact would be more likely to lie in the instability of the bird population than in the census-takers. The greater dangers of error in a count spread over two days are more apparent than real; it is arguable that by this method one obtains a more reliable result than by any attempt to secure an instantaneous view of the bird population. Any census is bound to give an illusion of exactness to what is in reality ceaselessly fluctuating; statistics may make it appear, for instance, that the population of Liverpool stands for ten years at 746,421 and then jumps in a night to 802,940, but in practice obviously two exact counts on the same day might show a discrepancy of up to a hundred thousand.

The November and the December censuses were both complete, and the greater part of the period between them was abnormally cold; when the second was taken the Round Pond was frozen over, and had been for many days. The results of these two counts were as follows:—

Species	First Census 2 and 4/11/25	Second Census 3 and 5/12/25	Rise or fall
House Sparrow ...	2603	2595	−8
Starling	411	343	−68
Black-headed Gull ...	289	440	+151
Woodpigeon	241	226	−15
Mallard	240	9	−231
Moorhen	26	20	−6
Blue Titmouse ...	37	17	−20
Great Titmouse ...	19	18	−1
Blackbird	21	15	−6
Robin	16	12	−4
Pochard	16	0	−16
Tufted Duck	7	0	−7
Skylark	11	0	−11
Redwing	0	15	+15
Common Gull... ...	0	14	+14
Chaffinch	10	9	−1
Throstle	4	10	+6
Dunnock	6	7	+1
Wren	6	4	−2
Jackdaw	2	8	+6
Mistlethrush	3	1	−2
Greenfinch	2	1	−1
Carrion Crow	5	4	−1
Stockdove	0	7	+7
Coal Titmouse ...	3	0	−3
Pied Wagtail	1	2	+1
Gadwall	1	0	−1
Pied Woodpecker ...	1	1	=
Brambling	0	1	+1
Totals ...	3980	3779	−201

The special points raised by this table may briefly be dealt with. The extraordinarily slight fluctuation in the number of sparrows proves how little such birds are affected by cold so long as their food supply continues. We only noticed one dead sparrow, leaving, from the unpractical standpoint of pure mathematics, seven others unaccounted for. But the closeness of these totals masks a very considerable upheaval. In November there had been 595 sparrows in the sections west of the Broad Walk; in December there were only 238. Across the Broad Walk there had been an equally striking redistribution; the "back

blocks" of trees were everywhere almost emptied, and the neighbourhood of the Round Pond and Long Water had attracted large numbers; the increase on the banks of Long Water was from 499 to 825.

A similar but less remarkable redistribution of starlings was brought to light. In the border sections (totals: November, 135; December, 143) they were very steady, but in the central and north central divisions they fell sharply from 219 to 76 and in the southern group they rose remarkably from 57 to 124. The great majority were feeding on the grass in sunny open parts; they are little dependent on man. The redistribution may reasonably be traced to the fact that while the central and northern areas are level, the southern have a sharp fall towards Kensington Gore, and so catch enough sun to be easily thawed when the other part is frozen. The greater softness of the ground on this slope was very noticeable. Taking the figures at their face value about 143 starlings were driven out of the central and north central divisions, of which 67 found room in the southern, 8 on the borders and the remainder were expelled from the gardens altogether, perhaps no farther than Hyde Park. This is an interesting instance of the effect of frost on the starling population, and it shows how in hard winters like that of 1916-17 great numbers of the normally stationary native race are frozen out and migrate (not south but westwards) looking for soft feeding-grounds. For example, a starling marked in Berkshire in 1913 was recaptured at home in February 1915 but finally in Cornwall in the arctic February of 1917.

Influence of Weather.

The prevailing weather, an unbroken frost of more than a week's duration, accounted for the wholesale desertion of mallards, pochards, tufted ducks and the gadwall, which fell by 255 all told. The increase of 165 shown by the more aerial and mobile gulls is significant and cannot be treated separately; the contrast may be read to mean that fine cold weather may freeze out the ducks without diminishing the supply of offerings from human visitors, and the removal of their competition leaves the gulls with a monopoly and results in an increase of their numbers. This after all is only statistical evidence of the intensity of the struggle for existence between the two forms which can be observed in progress at any hour of the day. The number of gulls on the Round Pond varying from hour to hour if not from minute to minute, is not, as it seems, fortuitous; it is adjusted by the interplay of complex forces of supply and demand as exactly as is the price of butter. The larger birds do not (except by the migration of the ducks to the Serpentine) show any traces of having suffered badly through the hard weather, nor do the sparrows, which are dependent on man; but with smaller insectivorous kinds the case is very different. The decline of the starling has already been described. The three titmice lost 24 in the month out of a total strength of only 59. The blue tit was the worst sufferer with a drop of more than fifty per cent; the larger, sturdier great tit was scarcely affected The London parks are apparently among the few places where no one makes any attempt to feed these birds. The blackbird also lost thirty per cent and the robin twenty-five per cent. On the other hand the appearance of 15 redwings where none had been found before, and of 7 stockdoves and 6 new throstles pointed to a slight influx of refugees from other parts. The jackdaw is a resident but several of the birds wander freely in the dead season and the full strength — about 4 pairs lately—was not invariably present.

The Third Census.

On 3rd January, 1926, the third census fell due. It was not planned on the same scale as its predecessors, for the data already obtained were enough to indicate which sections contained the highest proportion of the total population and which were most sensitive to change, and the labour involved, difficult for any observer who has not attempted such a task to appreciate, discouraged unremunerative effort. The area selected stretched right across the gardens from the Long Water to the south-west corner. Before the count began it started to drizzle, and the rain, getting into its stride, poured down without intermission for the rest of the morning. All that could be said was that for part of the time it was not nearly so hard as it was for the other part. This did not tend to make the business pleasanter, but the changed conditions were at least interesting. For ten days now the weather had been consistently rainy and the parks comparatively little frequented. In the 12-hour periods from Christmas Day to New Year's Day inclusive the rainfall at the Palace had been 1.5mm., nil, 3.8, nil, 1.4, 3.8, 1.5, .9, 5.8, 10, 7.5, 1.4, 3, .9 — total 33.5 millimetres or about one and a third inches, very evenly spread. As I expected, the numbers of sparrows in the crowded sections, where in better weather food is lavishly provided, proved to have fallen catastrophically; in other sections the fall was only slight. Blackbirds, robins, starlings and tits, which had suffered most before, were flourishing; ducks were more scattered but not seriously reduced. In order to save space the table for this January

census is combined with the next and final one, taken two months later, on 3rd and 5th March. (The figures for the 3rd March only affect the two check-counts for the Round Pond).

The 5th March came at the end of almost a week of generally fine weather, interrupted occasionally by sudden storms and even blizzards. Although their far from abolishing the struggle for existence, appears to intensify it, or rather to cause an abnormally bitter struggle for easy existence (which may humanly be compared to the effects of a "gold rush" in America).

The bird populations recorded cannot be taken to throw any light whatever on the normal density of bird population in Britain, owing to the abnormality

COMPARATIVE FIGURES FOR CERTAIN SECTIONS

	XV and XVI (by Long Water).				X (behind Peter Pan)				XIX and XI (Back Blocks).				Aggregates			
	Nov.	Dec.	Jan.	Mar.	Nov.	Dec.	Jan.	Mar.	Nov.	Dec.	Jan.	Mar.	Nov.	Dec	Jan.	Mar.
Sparrow	447	636	225	503	249	248	236	368	292	258	133	109	988	1142	594	980
Starling	9	0	6	3	53	21	78	74	63	14	79	4	125	35	163	81
Woodpigeon	7	17	3	31	43	20	59	36	22	4	12	22	72	41	74	89
Blackbird	5	3	0	4	0	1	4	2	2	0	4	0	7	4	8	6
Robin	4	2	2	0	—	—	—	—	—	—	—	—	4	2	2	0
Great Tit	5	0	0	1	2	3	0	3	5	3	4	0	12	6	4	4
Blue Tit	2	1	0	2	3	3	3	5	6	1	5	0	11	5	8	7
Chaffinch	0	0	0	1	0	3	1	6	9	0	1	0	9	3	2	7
Throstle	—	—	—	—	—	—	—	—	—	—	—	—	2	1	4	1
Dunnock	—	—	—	—	—	—	—	—	—	—	—	—	2	0	0	2
Pied Wagtail... ...	—	—	—	—	—	—	—	—	—	—	—	—	0	1	1	0

MARCH ONLY: Redwing, 6; Carrion Crow, 4; Mistlethrush, 2.

WATER BIRDS.

	Long Water.				Round Pond.				Aggregates			
	Nov.	Dec.	Jan.	Mar.	Nov.	Dec.	Jan.	Mar.	Nov.	Dec.	Jan.	Mar.
Black-headed Gull	53	147	12	51	215	287	255	195	268	434	267	246
Common Gull	0	3	1	2	0	11	14	9	0	14	15	11
Mallard	35	4	49	65	205	0	146	109	240	4	195	174
Tufted Duck	—	—	—	—	7	0	5	46	7	0	5	46
Pochard	—	—	—	—	16	0	18	41	16	0	18	41
Moorhen	24	19	30	18	—	—	—	—	24	19	30	18
Coot	0	0	4	0	—	—	—	—	0	0	4	0

TOTAL SPARROW POPULATION.

Nov.	Dec.	Jan.	Mar.
2603	2595	1840	2505

(Jan. and March are estimates based on incomplete counts; other methods of estimating gave for Jan. 1775-1813 and for March 2690.)

retirement from London was now due, gulls, pochards, and tufted ducks maintained or even exceeded their normal numbers. This, at any rate in the case of the ducks, pointed to an influx of birds on passage.

The results of the census led me to the following conclusions. Kensington Gardens, where bread is given away in quantities instead of having to be searched for, are such an outstandingly attractive habitat for the particular species which flourish in them that whatever gaps may be caused by mortality are immediately filled by an eager pressure from outside. The total population probably remains pretty constant at all seasons in normal weather; when an exceptionally rainy spell occurs and people cease to find much to attract them in the sodden park, the food-supply drops suddenly and an exodus takes place, probably in proportion to the length of the spell. That many wait to be starved out is unlikely; but the reputation of the gardens as a land flowing with milk and honey, of the circumstances. The area of the gardens is given as 275 acres, and the average density in November was therefore 14.47 (over 7 pairs) to the acre. In December it had fallen to 13.74. But the distribution was very uneven. On the Long Water in November there were 112 birds to 9 acres—about 12½ to the acre or well under the average for the whole gardens—but on the Round Pond there were 444 birds to 7 acres or 63.4 to the acre. A month later when the pond was frozen over there were only 298 (still over 42 to the acre); in January there were 438 (62.6 per acre); and in March 400—over 57 to the acre. The highest density on the Long Water was 19 to the acre, a striking contrast, since this last is intrinsically the more favourable for bird-life, having very much better cover and feeding grounds. The explanation of course is that the Round Pond is accessible to the public on all sides and is much more suitable for feeding water birds; the general ambition is not to hunt but to be fed.

The greatest density of bird population anywhere recorded by the U.S. Bird Census was on a suburban estate near Washington—135 pairs of 40 species on 5 acres, or 54 to the acre, but these I believe were permanent inhabitants and in any case the number of species represented was eight times as great as on the Round Pond. In British Guiana Beebe counted 464 *species* of birds on a quarter of a square mile of tropical jungle.

In the absence of statistics for comparison it is difficult to say whether the winter density of bird population on the Round Pond could conceivably be equalled without artificial encouragement. In any case the maximum density in Kensington Gardens was not here but in the long narrow division west of the Long Water, where on an area which cannot be more than 5 acres at the most there were in December 659 birds, and in March 545, the densities being in the region of 140 and 109 respectively—possibly greater. Conversely there were large areas very sparsely populated with birds.

Some Conclusions

My impression was that the bird population had become artificial and dependent on man to such an extent that out of less than four thousand birds more than three thousand would be starved or driven out if the gardens were suddenly closed to the public. The five leading species numbered in November 3,784 (all but 199 of the whole population), and of these the house-sparrow, mallard and black-headed gull are almost entirely, and the ringdove and the starling very largely, dependent upon man. Without him I doubt if the gardens would support more than about 60 of the 2603 sparrows, 15 of the 289 gulls, 30 of the 240 mallards and perhaps as many as 70 of the 241 woodpigeons and 200 of the 411 starlings. That, of course, is nothing more than an opinion, based on the numbers of these species present on roughly similar estates where the birds are not fed; it takes no account of the fact that if the ground were used for other purposes (as a housing estate or to grow crops, for example) or even if it were left entirely to its own devices it would gradually make good part of the loss by attracting a fresh avifauna. As to the gulls, it is doubtful whether any would spend much time in Kensington Gardens, if there were no people there. Professor Forel found that on Lake Geneva the summer population of black-headed gulls numbered about 300-500 and the winter (September-March) about 3,000, giving from one bird on 480 acres (summer minimum) to one bird on 48 acres (winter maximum); at this rate the Serpentine, Long Water and Round Pond together would support precisely one gull. But some allowance must be made for areas of Geneva too deep to be of much use to gulls.

Another interesting point was that of the four most numerous species three—the starling, woodpigeon and black-headed gull—retire to the last bird to roost in some other place during the winter months, the gulls to the Thames reservoirs, the starlings about Trafalgar Square, St. Paul's and in between, and the woodpigeons to the Serpentine island or Battersea Park. The night population in winter must therefore be about a thousand less than the day population.

I should not end without acknowledging more fully the help given by my brother. He took part in all but the last of the four counts, and having to undertake that alone made me realise that without his skilful and ready assistance my project could never have been carried out. Although so far as its original object of throwing light on winter mortality was concerned the census proved a dead failure, the incidental results were, I think, of sufficient value to justify the labour of making it. But whatever may have been accomplished the need for a bird census of some characteristic part of England, and if possible of more than one, remains unaltered. With the additional complications of arbitrary boundaries, fluid population and an immensely greater area to cover, the difficulties may well discourage the most enthusiastic observer, but the occasion is there, waiting for ornithologists to rise to it.

Excavations at Ur.

IT has now been decided by the Trustees of the British Museum to continue the grant this year for further excavation at Ur of the Chaldees. Work on the site was begun last year by Mr. C. Leonard Woolley, whose plans for this season are understood to be concerned with the mound which was tested in ten days' work at the end of last season, when a small gang partly examined one flank. In one of the chambers excavated a large number of inscribed tablets of clay were found. Though they have not yet been deciphered, states *The Times*, it is certain that they are chiefly religious literature, dated about 2100 B.C. One of them is a poem on the city of Ur. It is assumed that the main building lies under the mound, and Mr. Woolley intends to work steadily on that. With 300 men he expects the work will take fully three months, and a start will be made at the beginning of November. Part of the cost of the expedition, as last year, will have to be met by public contributions, and it is hoped that these will be forthcoming.

A Soldier Discovers Industrial Life.

By Lt.-Col. A. A. Hanbury-Sparrow, D.S.O., M.C.

The following comparison of military and industrial organization involves interesting—if somewhat controversial—considerations, and suggests that much may be learnt from research on these lines. The writer had some thirteen years' commissioned service before he left the army eighteen months ago to take up business in the cotton trade.

To appraise the relative efficiency of two dissimilar objects is never easy. A Fordson tractor and a race-horse can both draw a plough, and both can get round the Epsom race-course, yet a comparison of the two, based on their ploughing or racing capacities, is self-evidently unsatisfactory. Unless a fair standard of measurement can be found, it is not possible to form a just estimate of their comparative merits.

A similar difficulty faces one in comparing military with industrial life. The two are totally unlike both in their organization and their purpose. The objectives of the army are service and efficiency; and as morale is as three to one, so the army seeks to serve the State through the efficiency of the individual. The men and the State: those are its two leading ideas. Industry, on the other hand, seeks profit. The State may intrude on industry as a tax-gatherer, a regulator of trade, or a social reformer, but never as a mistress. In a capitalistic society the idea of the State never appears as the philosophic justification of industry, although the idea of patriotism is not necessarily absent. Hence there is an enormous difference in the mental background of the soldier and industrialist. Profit is an element as unknown to the one as State service is to the other. Starting from different standpoints their thoughts rarely run in the same channels.

Difference in Organization.

And just as the goal and mentality are different, so are the organizations. The army is an aristocratic socialism. It is socialistic in the sense that it is non-capitalistic; it is aristocratic, not only because its leaders are mainly recruited from one class, but because the lives of its members are governed by status rather than contract. The soldier is throughout every hour of his service subject to military rule, and during that same period the State is responsible for his welfare. An industrialist is not answerable if large numbers of his workers contract venereal disease in their leisure hours, but this is the case with a battalion commander. This last fact really sums up the situation in a nutshell. The difference is profound, enormous; and it is extraordinarily difficult for the soldier to assimilate the point of view of the industrial employer or workman in regard to their relationship with each other.

It is necessary to stress the vast gulf between military and industrial life in order that the reader may appreciate the difficulty of estimating with detachment the worth of their respective characteristics. Great caution is clearly necessary, and the only aspect that it is possible to compare with any approach to fairness is the human element.

"Under-Officered."

"Under-officered"—that was my first impression of the cotton and its auxiliary industries. This impression has on the whole been strengthened by time. Lancashire has too many quartermaster-sergeants doing the work of company commanders. It is probably true that she is succeeding with them far better than the army could do. It is certainly true that she can recruit them from a class—the lower middle—that never comes into the army. But the same weaknesses appear here as appear in the army under similar conditions. There is the same narrowness of outlook, the same preference for routine and rule of thumb, and the same suspicion of anything new. One gets the impression, too, that the men are not always handled by their managers as wisely as they should be. But possibly the officer class in industry does no better, for whereas in the army the young officer is carefully instructed in the art of "telling off" men, in industry it is done more in the light of nature than anything else. As a result there is perhaps too much reliance on personality and threats, and too little on systematic investigation of the trouble.

The shortage of officers is increased artificially by the motor. In increasing numbers they live away from their work, and the tendency seems to be to seek "staff" rather than "regimental" employment. An illustration of this is to be found in the well-known saying "Liverpool gentlemen and Manchester men." If profits should ultimately be found to rest on the efficiency of the workers and not on world price, the wisdom of this tendency seems doubtful. In any case, there can be little doubt that the army hierarchy from corporals upwards is considerably better educated than are its opposite members in industrial life. Here

specialization begins too early. Most boys go into business immediately on leaving school. Although their parents might well be able to afford it, few attempt the varsity. The reason generally given is that unless the boy is caught young, he will never stand the drudgery of business. This may be true, but the remedy is possibly worse than the disease. For in the first place the amount of technical knowledge that can be taught in any one firm is limited by the knowledge of that firm, and to obtain further knowledge is difficult. Competitors are certainly not going to give away their secrets, and for some reason the technical schools are not used in the way they might be. During the last winter the writer has attended the day weaving class at a certain technical school, and has been the only pupil taking the course. In the second place, it is always doubtful how far a specialized education can take the place of the old classics in giving the power of balanced judgment. If industry could run a staff college something on the lines of the Camberley one, for picked men between thirty and forty years of age, and provide a series of "refresher courses" for managers, the results would probably be beneficial not only economically, but politically in its effect on working-class opinion.

A haze of mutual mistrust befogs many things industrial. It is often very difficult to get at the truth of any question. Every employer carries a load of secrets. Loose organizations of firms are constantly forming and as constantly breaking up as self-interest dictates. The very instability of demand and supply, the impossibility of controlling world prices, the uncertainty of such natural elements as weather, and the necessity of looking after oneself, probably make such an atmosphere inevitable. But, on the other hand, two positive qualities do emerge from it—watchfulness and energy. The system supplies its own driving power, unlike the army which has to spend great energy in keeping its members "up to the mark." In this respect industrial life is more nearly self-acting, and the economic wastefulness of this form of supervision is obviated.

Waste of Brain Power.

The charges of waste against the system are difficult to maintain, that is to say, waste in the usual meaning of the word. With such uncertain factors as supply and demand there is bound to be a certain surplus margin of production, and there are bound to be a certain number of miscalculations. These defects would appear whatever the system, and routine waste has been all but eliminated. But there is one charge of waste which is not so generally levied, but which does appear to have considerable justification, and that is the waste of brain power. Industrialism has killed craftsmanship, and the workers have no intellectual problem to chew. Their brains are not used near their full capacity. When the school-leaving age was ten, boys went at that age into the mills as doffers; to-day they must be fourteen before they can take up that work. Obviously it is wasteful of brain power to employ a boy of fourteen at work that a child of ten can do. This is a fair example of the disease that festers its way through nearly every grade of worker in the cotton trade.

Technical Education.

In the army this problem of over-education does not arise. It is the other way round. But in the cotton trade it is a very real evil, nor are the leaders of the industry acting as though they appreciated its gravity. For not only does it cause a feeling of drudgery and apathy amongst the workers, but it positively invites successful oriental competition. The key to the recovery of the Lancashire cotton trade might well lie in raising the intellectual qualities required in successful spinning and weaving. If that could be done, the latent capacities of the workers would probably defeat all foreign competition. But apart from this the remedy is far to seek; to put the workers to tasks not above the capacity of a Bombay mill-hand is to invite disaster.

The characteristics of the various branches of the army vary in proportion to the amount of routine involved in their work. In the infantry there is little routine; in the cavalry and artillery horses have to be fed and the routine is greater; in the R.A.S.C. and auxiliary services the routine approaches the standards of civil life. And the type of discipline varies with the amount of routine. In the infantry it is very unlike civilian standards; but in the R.A.S.C. civil and military discipline almost meet, and there is probably little to choose in the relative efficiency of the civil or military clerk and mechanic. During the retreat from Mons the quickstep was forgotten; our men insensibly sank into a long slow stride. Later, when the morale of the army improved, the quickstep came back. But it is the long slow stride of the retreat that pervades industrial life to-day, and the workers seem tolerably contented as long as they are not hustled out of that pace. They will keep at it with astonishing regularity and very little supervision. But is it fast enough? It is literally and absolutely true to say that an army that cannot march at the quickstep is not good enough to defeat on the field of battle the army that can. How far does this analogy apply to the economic battle?

So far as any lesson emerges from these last obser-

vations it is that, given the same task, the British worker tends to react towards it in the same way, regardless of the ethics of the system under which he is serving.

The worker himself seems to prefer being regarded as an economic machine. Provided he does a decent day's work, the employer has no right, in his opinion, to concern himself with the worker's views or his recreations. Though quite willing to accept something for nothing—a sports ground, for instance—he would bitterly resent the idea of compulsory games on it as interfering with his liberty. It is this kind of attitude that renders futile most attempts to introduce esprit-de-corps into industry.

Esprit-de-Corps.

In esprit-de-corps the army has a moral idea of great power and boundless possibilities. It provides a healthy chain of rivalries and loyalties which extends unbroken from the section to the State. There is no equivalent for it in industrial life, nor does it seem to enter into any social reformer's Utopia. It may be that it is impractical; perhaps it is. The attitude of the employers, the policy of the trades' unions, and the fundamental conservatism of the working classes, all tell against its introduction. The objection of the unions to any form of punishment, except dismissal, is alone sufficient to prevent it because, to maintain discipline, it is necessary to give foremen and others of their standing the power to engage and dismiss. Consequently, whilst most works retain a strong cadre of permanent hands, there is always a floating population which drifts in for a few weeks' work and then drifts on again to another job, and it is hopeless to attempt to inculcate esprit-de-corps amongst casual workers of this type. Besides, why should they feel it, when they are liable to be paid off whenever business is slack? Such esprit-de-corps as there is goes to the Unions, and not the business.

How far the teachings of the army are applicable to industry is open to question. Certainly the army has grasped more fully the value of education and intelligence work, and is far ahead of industry in the development of these subjects. It is also probably further advanced in the art of higher command and organization. But it must be remembered that it only attains these superiorities through the exercise of a military code of law which it would be impossible to impose on the nation as a whole. Nevertheless, that is not a complete reason for industry to reject out of hand all its teachings. Several of them could almost certainly be modified to fit the industrial scheme of things, and in so doing some of the troubles between labour and capital might begin to disappear.

Correspondence.

ORIGIN OF THE WORD "TELLAR."

To the Editor of DISCOVERY.

SIR,

In his most interesting article on "The Woodman and his Craft" in your last issue, the writer—Mr. G. L. Jarratt—in stating that the derivation of the term "*Tellars*" to those trees which are left standing "appears obscure," has probably overlooked the connotation of the word in the saying "It takes seven tailors (*tellers*) to make a man" as applied to the seven strokes of the passing bell to indicate the sex of the deceased or "*tell*" the hearer that he was "a man."

The trees are probably left (perhaps every tenth tree) to "tell" now many had been "thrown," and so enable a correct count to be made after removal of the timber. For a similar use of the word "*tell*" for "count" *vide* "*tell* beads" for enumerating prayers on a rosary and "*tell* the towers thereof"—Psalm 48, 12. "I may '*tell*' all my bones"—Psalm 22, 17.

Yours, etc.,

T. LEONARD JENKINS.

Leigh Village, Sherborne, Dorset.
5th July, 1926.

"SAND IN MAGICAL CEREMONIES"

To the Editor of DISCOVERY.

SIR,

With reference to the article on the use of sand in magical ceremonies by Mr. Canney in a recent number of *Discovery*, my own experience on the shore of the Red Sea may be interesting. The basis of the use of sand in magic, or at least one of the bases, would seem to be its use for ordinary cleanliness (as apart from the later magical ideas), comparable to the use of floor-coverings among ourselves.

My village was on a plain of sand made sticky and coherent by salt. As this sand was carried here by wind from the desert, it was largely dust, which would cling to garments and our bodies if we lay down on it. About three miles out to sea was an islet with white beaches of coarse sand made of fragments of shell and coral, and both the natives and ourselves used to bring this sand over in baskets to cover the floors of our huts. Naturally, as the cleanliness of places of prayer was more important than that of mere houses, more care was taken to keep these covered with this clean white sand, but there was no magical idea in this, any more than in Sultan Hamid's sending carpets to the Dome of the Rock in Jerusalem.

The origin of drawing in sand was also illustrated by a habit many natives had when assembled in a "meglis" or meeting to discuss some matter of local politics. The company was, of course, squatting on the sand, and it was a frequent habit for the speaker to make lines and marks on the ground while talking. All the company were illiterate, but the marks on the sand seemed to assist memory, define the facts presented, and make for emphasis and order. It was entirely different to the scribbling upon blotting paper indulged in by a member of a committee of ourselves, which is for the time engaged upon a subject in which he cannot profitably take part. From this origin of the uses of sand the transition to its magical uses is direct and follows the usual lines, utility forgotten and superstition remaining.

Yours sincerely,

CYRIL CROSSLAND.

Papeete, Tahiti.
29th May, 1926.

Problems in the Natural History of Ormers.

By T. A. Stephenson, D.Sc.

Department of Zoology, University College, London.

The ormer is a mollusc much sought after as a table delicacy. Many details in its natural history have yet to be discovered; of recent years there has been a shortage of ormers in the Channel Islands, and the causes are being investigated by the government.

THOSE readers who have visited the Channel Islands will be familiar with the name "ormer," a name applied in that district to the edible mollusc *Haliotis tuberculata*. The American "abalone" is a counterpart of our "ormer," and applies to other species of Haliotis. The word "ormer" is a corruption of *oreille de mer* (ear of the sea) and the scientific name Haliotis bears the same interpretation, both being derived, presumably, from the somewhat ear-like form of the animal's shell. The genus Haliotis belongs to the Gastropod or univalve molluscs; it is widely distributed in the world and contains many species. The European *H. tuberculata* is by no means confined to the Channel Islands, but these are practically its northern limit; on the coast of France it occurs extensively from Barfleur southward, also in the whole Mediterranean.

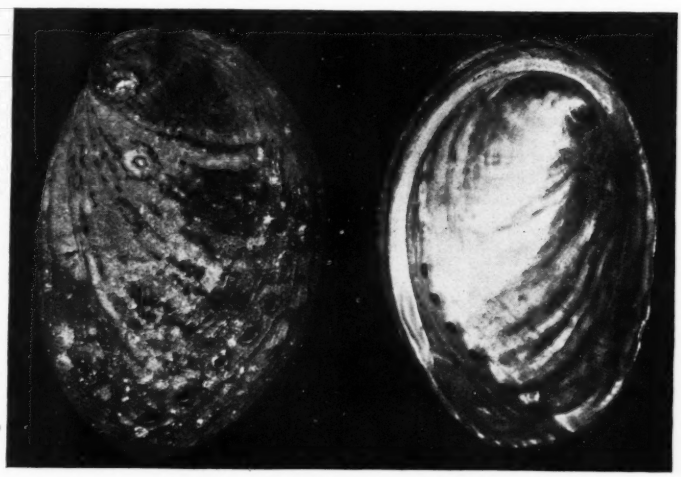

FIG. 1.
THE SHELL OF *HALIOTIS TUBERCULATA*, REDUCED.
The right-hand photograph shows the inside of the shell.

The shell of *H. tuberculata* is illustrated in Fig. 1. It is a shallow shell, pearly inside and rough externally, and although at first sight not much like the average gastropod "snail" shape, it is derived from this by flattening, and a slight spiral still remains to it. The row of holes in the shell is a characteristic feature. Fig. 2 shows a living ormer creeping; in this can be seen the long head-tentacles, the small eyes on stout stalks, three mantle-tentacles projecting through three of the holes in the shell (this is a normal feature), and various other points. For this drawing of a living specimen I am very much indebted to Miss D. R. Crofts.

A living specimen of Haliotis in full career under water is one of the most attractive sights to be seen among marine animals. To begin with the shell is not dull in colour externally as in dried examples, but often, especially in young and clean ormers, is banded with green and purplish brown. Then the animal itself is coloured elaborately with varying shades of green, grey, and purple; it has round it a sort of skirt (epipodium) fringed with long waving green tentacles and with grey-and-white frills. The flat underside of the animal—the sole on which it creeps—is quite different, being cream-coloured or yellow; and if the creature is placed on its back it can right itself, generally with great *éclat*, by attaching the tip of its tail to the rock, rearing itself erect thereon, and then collapsing on to its sole again.

The habit of the animal is roughly similar to that of the limpet; it clings to stones with considerable force, attaching itself by means of the broad muscular sole. But in several ways it is very different from a limpet. In the first place it is much larger than the British limpet; the shell illustrated here is nearly $4\frac{1}{2}$ inches long, and it can be larger; also the animal when well extended is about twice as long as the shell. Then again it is the habit of the limpet to stay in one place on the rocks, wandering away to feed at intervals, but returning home afterwards; when it wishes to do so it can hide its entire body beneath its shell, and as we all know when it decides to stick to

its rock it sticks with terrific force. An ormer, contrariwise, has no fixed home, as far as is known; it cannot enclose its body completely under the shell, a good deal (*i.e.*, the epipodium), projecting beyond at the best of times; and although it sticks very firmly to its stone it is easier to detach than a limpet. A limpet is a slow mover; an ormer walks very rapidly for a mollusc, and it can cover something like five to six yards a minute. A limpet if touched will close down and "stay put" for some time but an ormer, after being pulled at and left alone, will as likely as not run away in a minute or two, and can often be caught in the act.

In the Channel Islands ormers are, of course, a well-known delicacy—as also they are elsewhere—and their method of capture is as follows. They inhabit the lowest fringe of rocky shores, the part of the shore also colonized by the large tangle weeds (*Laminaria*). Their zone is only extensively uncovered at low water of spring tides, and it is then that they are sought for. One finds them by turning over stones and boulders in the Laminarian zone, or searching in cracks and feeling under rocks which are submerged even at the lowest tides; they are most often met with on the undersides of clean boulders which are not embedded in sand. There is a knack in nipping them off before they have time to put their clinging powers into full action.

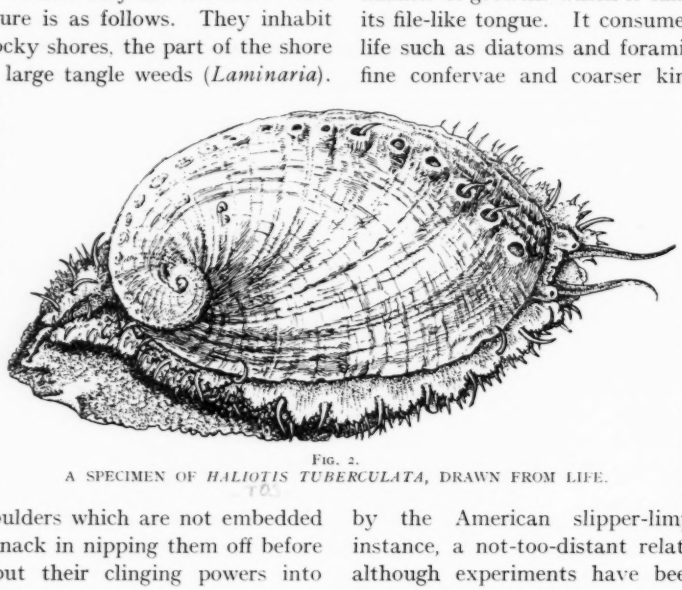

FIG. 2.
A SPECIMEN OF *HALIOTIS TUBERCULATA*, DRAWN FROM LIFE.

The holes in the shell are connected with respiration and with the elimination of waste material. The region of the animal that lies beneath them is a cavity, known as the mantle cavity, which contains a pair of delicate gills. It is necessary, for breathing purposes, that a stream of water should be maintained passing between the folds of these gills. This current is created by cilia on the gills themselves; and although the finer details have not been worked out in Haliotis it is assumed, probably correctly, that the stream enters under the edge of the shell and passes out through the row of holes. A partly-dissected Haliotis is shown in Fig. 3, and in this the general arrangement of parts may be made out. The shell has been removed, together with the most superficial underlying parts, and the animal is viewed from above. A little to the right of the centre of the figure, rather above the middle, is a large oval area; this is the large shell-muscle which attaches the animal to the shell; it is continuous with the creeping sole before mentioned which cannot, however, be seen in the photograph. To the left of the shell-muscle can be seen the two gills, frond-like structures, between them lying the rectum. The small structures behind the gill and rectum are the left kidney and the heart. The somewhat featureless expanse forming the posterior part of the animal, and sending a horn forward on the right of the shell-muscle is the visceral mass, containing gonad, food-canal, and so on.

Haliotis is a browsing animal, feeding upon all manner of growths which it can rasp off the rock with its file-like tongue. It consumes microscopic forms of life such as diatoms and foraminifera, seaweeds, both fine confervae and coarser kinds, also sponges and polyzoa; and it takes in a good deal of sand incidentally. It has been suggested that it may also be able to strain out food suspended in the water, with the help of its gills. Feeding by means of collecting particles from a current is a common method in the sea, and among gastropods it is certainly adopted by the American slipper-limpet (*Crepidula*), for instance, a not-too-distant relative of Haliotis. But although experiments have been made on Haliotis from this point of view, no final result has been obtained, such evidence as there is suggesting that Haliotis does not feed by a current to any extent.

The whole life-history of *Haliotis tuberculata* is not known in detail; but we are able to sketch in the main lines of it quite definitely. The sexes are separate; and while there is no obvious external difference between a male and a female, it is possible as a rule to tell with which one is dealing by turning down the hinder part of the animal's foot, and with it the epipodium, and examining the underside of its visceral hump (the part contained in the back of the shell). At a certain point close to the great shell muscle, it is possible to see the colour of the gonad through the skin, unless the latter is very heavily pigmented, but this does not apply to specimens below a certain size. The male gonad is usually

white or cream-coloured, sometimes with a greenish tinge, rarely pale yellow or salmon. The female gonad may be bright or dull green, various shades of grey-green, grey, fawn, or brownish, or even yellowish. The eggs are shed by the female into the sea, being fertilized after exit. They are quite loose from one another, and may be shot out in a cloud by the female through the holes in its shell. They are minute pale green spheres, each enclosed in a fine transparent shell, and sink to the bottom after extrusion. Sperms are provided by the males, who puff out clouds of them and make the surrounding water milky.

The extent of the breeding season is not known, but certainly the early part of August lies within it, and it is probably late summer. After an egg is fertilized it rapidly develops into a small mobile embryo; in less than a day it has reached a trochophore-stage, and is a ball of cells with a girdle of well developed cilia whose action may cause it to revolve in the eggshell. Before very long it may escape from the shell and swim freely in the water, changing its shape as it grows, until the cilia form a well-marked crown at one end of it, separated by a short neck from the rest of the body.

How long the free-swimming period lasts we do not know, but, at any rate, after a time these larvae settle down and take to a creeping life, and become miniatures of the adult in form. Again the rate of growth after creeping has started is still partly a matter of conjecture, but enough observations have been made to render it likely that it attains a length of not more than about 3.5 cm. (in average cases), in its first year, and that it can spawn at about three or more likely at about two years old.

Fig. 3.
A PARTIALLY-DISSECTED SPECIMEN OF *HALIOTIS*.
For explanation, see text.

Haliotis tuberculata is not a suitable animal for keeping in an aquarium unless the best conditions can be provided for it. It appears to require very good aeration, and does not always do well even then, although under such conditions it may live and flourish. Specimens for observation can easily be kept in a basket anchored in the sea, but if small ones are to be kept in this way, the mesh of the basket must be very fine, as they have an uncanny ability for squeezing through cracks incredibly too small for them.

An ormer is able to live for some time after its shell has been removed; M. Boutan has kept ormers for months in this condition and finds that a new shell is regenerated. But the new shell is abnormal and easily falls off; nothing daunted, however, the animal renews it yet again, but it is a poor substitute for the original one. M. Boutan has also been able to produce pearls in Haliotis, by the introduction of foreign particles in a suitable manner.

In the Channel Islands Haliotis has attracted special attention recently because in Guernsey, at any rate, it has become markedly more scarce of late years. This scarcity does not appear to extend to the neighbouring coasts of France, as far as one can tell. In order to find out what has caused this decrease (which has been taking place during the last twenty years or more according to the average estimate), the States of Guernsey initiated a biological investigation of the mollusc during the summer of 1923. The result of this was to throw a certain amount of new light upon the bionomics of the species, and the conclusion was that such a scarcity could probably be brought about by (*a*) overfishing, together with (*b*) too ruthless a disturbance of the beaches, leading to a certain diminution of the food supply over the area within which Haliotis is available for fishing. If this is not the main cause, it is probably to be looked upon as a natural fluctuation, due to causes unknown, spread over a period of years and perhaps reversible. As a result of the investigation the States legalized a period of two years during which fishing ormers was prohibited; the outcome of this has yet to appear.

Ormers, like any other beasts, have their enemies; we have not much accurate information about these, but we know a little. There seems little doubt at any rate that starfishes, octopods, and oyster-catchers may be reckoned among them; each of these is alleged to attack ormers, by credible observers. But although one can go thus far, there is no evidence

as to the extent to which any of these creatures will account for ormers—whether they make merely occasional or fairly steady demands upon the ormer-supply. Probably in the case of octopus, the ormers do form a small part of the normal menu. Octopus is an animal which lurks in holes underneath stones, or in cracks beneath overhanging rocks; around the mouth of its "den" it strews the debris of its meals, and one finds collections of shells and other remains as a guide to an octopus-lair. Haliotis shells occur as a sparing element among this refuse. Oyster-catchers get their opportunity at a low tide, when on a sunny day, perhaps, the haunts of the ormers are more than usually exposed, and some of them are hanging rather feebly under ledges and just under the lee of stones; from such places the oyster-catchers have been seen to knock them off. It must be said, however, that none of these animals can be put down as a serious enemy, there being nothing to suggest that any or all of them could be responsible for a shortage of ormers such as has occurred in Guernsey. There does not seem to have been any steady and regular recent increase of starfishes or octopods, comparable with the decrease in ormers. It is well known that octopus has good and bad years, but these occur spasmodically and do not affect such a question as this, unless it be to the extent that a very heavy octopus year might coincide with a poor ormer year.

Other suggestions were made which might have accounted for the Guernsey shortage, but on being followed up they did not throw light on the problem. No extensive contamination or steady silting up of ormer-sites seems to have taken place. Then there was the idea that a very slight average decrease in the temperature of the Channel-water might have taken place during recent years. This is the kind of thing about which decisive evidence is very hard to obtain; in any case, the change would be next to nothing, but one must remember that the Channel Islands form the northern outpost of the ormer, and that there if anywhere it would respond to a very small climatic change. Even if there is anything in this, legislation, of course, cannot save the situation!

More may be said as regards overfishing and disturbance of beaches. Guernsey is nearly twice as thickly populated as it was a hundred years ago, and ormers have been much fished—a fact which speaks for itself. Then again, although we do not know which element in an ormer's food forms the staple proportion, it is likely that the varied growth under clean boulders forms a certain part of it, perhaps a large part. During ormer hunts the boulders of an area may get overturned and left inverted, on a most extensive scale. This means that much of their edible coating dies of exposure, and a new one takes some time to grow. This may not hurt ormers much, but it may keep them lower down the beach, so that they are out of reach of fishing.

Books Received.

Bulletin of Imperial Institute. Vol. XXIV. No. 1. 1926. (John Murray. 3*s.* 6*d.*).

British Snails. By E. A. Ellis. (Oxford University Press. 10*s.*).

Science: An Introductory Textbook. By E. J. Holmyard, M.A., M.Sc., F.I.C. (J. M. Dent & Sons Ltd. 4*s.*).

The British Museum Quarterly. No. 1. (The Trustees. 2*s.*).

Essex: An Outline Scientific Survey. Edited by G. E. Hutchings. (Benham & Co. Ltd., Colchester. 3*s.*).

A Short Course in Elementary Meteorology. By W. H. Pick, B.Sc. (H.M. Stationery Office. 1*s.* 6*d.*).

Science Progress. No. 81. July, 1926. (John Murray. 7*s.* 6*d.*)

Catalogue of Chemical Books. No. 800. (Henry Sotheran & Co. 2*s.* 6*d.*).

Subject Index of the Transactions of the Optical Society. Vols. I-XXV. By A. F. C. Pollard, A.R.C.S., A.M.I.E.E., F.Inst.P. (Cambridge University Press).

The Decimal Bibliographical Classification of the Institut International de Bibliographie. By A. F. C. Pollard, A.R.C.S., A.M.I.E.E., F.Inst.P. (Cambridge University Press).

Healing by Manipulation. By J. Henry Jones. (Watts & Co. 2*s.* 6*d.*).

An Outline of Abnormal Psychology. By Wm. McDougall, M.B., F.R.S. (Methuen & Co. Ltd. 15*s.*).

A French Reader for Science Students. By Jethro Bithell, M.A. (Methuen & Co. Ltd. 3*s.* 6*d.*).

The Cancer Review. Vol. I. No. 1. 1926. (British Empire Cancer Campaign. 3*s.* 6*d.*).

Artifex, or the Future of Craftsmanship. By John Gloag. (Kegan Paul, Trench, Trubner & Co. Ltd. 2*s.* 6*d.*).

Contributions to the Art and Science of Otology. Lectures and Papers by Richard Lake, F.R.C.S. 1892-1925. (Macmillan & Co. Ltd. 15*s.*).

Power Alcohol Production. (H.M. Stationery Office. 6*d.*).

The Elements of Descriptive Astronomy. By E. O. Tancock, B.A. Second edition. (Oxford University Press. 3*s.* 6*d.*).

Crime and Custom in Savage Society. By Bronislaw Malinowski, D.Sc. (Kegan Paul, Trench, Trubner & Co. Ltd. 5*s.*).

The Antigone of Sophocles. Translated by Hugh Macnaghten. (Cambridge University Press. 2*s.*).

Proceedings of the Society for Psychical Research. Part 98. Vol. XXXVI. June, 1926. (Robt. Maclehose & Co. Ltd. 6*s.*).

The Month's Wireless Developments.

THE TELEPHONE JUBILEE.

By F. H. Masters.

(Editor of "The Electrician.")

On another page of this issue of *Discovery* Sir Oliver Lodge gives his reminiscences of the last British Association meeting at Oxford, thirty-two years ago, and pays particular attention to his own communication to that meeting, which is often referred to as the beginning of radio telegraphy. I shall therefore devote my space this month to an account of the progress that has been made in the cognate subject of telephony.

It is now fifty years since Alexander Graham Bell invented the telephone, and was able to communicate by this means from the attic of his house in Boston with an assistant in the basement. Sir Oliver Lodge, in his address to the Institution of Electrical Engineers at the jubilee celebrations a few weeks ago, described this new invention as the greatest of the nineteenth century, and point is given to this contention by the fact that the instruments now used by telephone subscribers the world over are substantially the same as those first employed by Graham Bell. All the improvements that have been made in telephone communication, and they are very numerous, have been directed to increasing the facility with which any one person can communicate with any other, and in ensuring that speech shall be transmitted intelligibly over the greatest possible distance.

The first problem is an engineering one and will not be discussed here, except to call attention to the ingenuity that has been exercised, especially in enabling one subscriber to call another without the intervention of an exchange operator. The second may, for the sake of contrast, be described as scientific; and its solution is in greater part due to the work of that curious mathematical genius, Oliver Heaviside.

The Problem of Distortion.

If a perfectly-insulated telephone transmission line is considered, it will be found that it possesses three definite characteristics: resistance, inductance, and capacity. None of these can be entirely eliminated, though any one can be reduced to a comparatively small amount. The effect of resistance and capacity in combination is to cause distortion, and speech, even through a comparatively short cable, was therefore impossible until Heaviside showed that it could be achieved by the inclusion of extra inductance. This led eventually to the loaded cables of Pupin, and the still more recent use of a special nickel alloy known as "permalloy." Though, therefore, a really distortionless cable has not yet been constructed, it is possible to conduct telephone conversations over considerable lengths of cable.

Even so, telephonic communication across miles of ocean is only possible by discarding the use of wire altogether, and using the ether as the transmitting medium. The ether has no resistance. It does not act as a conductor. The result is that it transmits electric waves entirely without distortion. In this way signals can be transmitted to any distance, and so the era of international wireless telephonic communication with all its wonderful possibilities is opening up. It forms a combination of wireless proper with telephony proper, which is of the highest scientific interest.

BROADCASTING AND EDUCATION.

By Edward Liveing, M.A.

(Manchester Station Director, B.B.C.)

The development of wireless has, of course, already been discussed at past meetings of the British Association, but on the occasion of this year's meeting, at Oxford, the educational value of broadcasting will find a place among other subjects to be reviewed. Mr. J. C. Stobart, the Director of Education of the B.B.C., is to give a paper on Broadcasting and Education. The effect of wireless talks in general, and of school transmissions in particular, on the raising of the community's intellectual standard cannot be over-estimated. Many a grown-up person will admit that his horizons are being greatly enlarged by the many talks which he is now able to listen to in the quiet of his own home, but in the interests of our own new experiences we are, perhaps, apt to forget the really vital importance of the part that broadcasting must be playing in the life of the growing child. We did not have the chances of listening to men and women famous throughout the world for their special knowledge of certain subjects speaking to us from loud-speakers in our class-rooms. It has been repeatedly said that, though wireless cannot possibly supplant the teacher, it can form a most useful supplement to his work by bringing into the class-room first-hand knowledge gained by the foremost researchers and scholars of the day. It will be interesting to hear the views of the educational section of the British Association on the educational value of broadcasting, particularly in regard to its influence on the child mind.

Another interesting point where broadcasting will establish contact with the British Association on this occasion is that the presidential address by the Prince of Wales is to be relayed to all stations on 4th August, between 8.30 and 9.10 p.m. The B.B.C. has also made arrangements for the reproduction of the speech by means of loud-speakers in the Town Hall and the Oxford Union Hall.

Autumn School Transmissions.

The programme of autumn school transmissions from the London and Daventry Stations has already been tentatively worked out. On Mondays Mr. E. Kay Robinson will deliver what will undoubtedly be a delightful series of talks on "Fishes," from 3 to 3.30 p.m.; on Tuesdays Sir Walford Davies is continuing his talk on "Elementary Music and Musical Appreciation" from 3 to 3.30 p.m., and a special new series of talks on "Makers of Modern Europe" has been arranged to take place from 4.15 to 4.30 p.m. on this day, this series being specially designed for secondary schools. On Wednesdays Miss Mary Somerville, in co-operation with Mr. Gerald Gould, will occupy the period from 3 to 3.30 p.m. with talks on "English Composition and Reading"; and on Thursdays school children will have an opportunity of hearing something about the world's great "Geographical Discoveries" from Mrs. E. Fielder Hodgson. M. E. M. Stéphan is delivering a further series of talks on "Elementary French" on Friday afternoons from 3.20 to 3.40 p.m., and the always attractive concerts by the People's Concert Society will be relayed and broadcast for the benefit of school children from 3.45 to 4.45 p.m. on the same day.

Book Reviews.

The Aryans: A Study of Indo-European Origins. By V. GORDON CHILDE, B.Litt.(Oxon). "The History of Civilization" Series. (Kegan Paul, Trench, Trubner & Co. 10s. 6d.).

Mr. Childe's title is at once a challenge and a reminder. It takes us back to the controversies of the last century; once more it raises the question whether there is or ever was an Aryan race. But any alarm that we are again to beat the air in a vain pursuit of an elusive abstraction is speedily dispelled by Mr. Childe's introductory chapter, in which he recapitulates the grounds for the philological hypothesis of a proto-Aryan tongue, and defines his objective in relation to that hypothesis. It is perhaps hardly necessary to recall that the philologists by an analysis of the Aryan languages, in accordance with the laws of linguistic and phonetic change, have concluded that these languages must have had a common ancestral form, and from the common elements have deduced an Aryan culture. They hold there must have been a people living within an area which had at any rate some geographical unity and under more or less uniform geographical conditions. This people, or peoples, had at least one common divinity—the sky god—and a common language must have endowed them with a common mentality markedly individual. By expansion, migration, conquest, or infiltration, Aryan speech and culture spread to regions previously non-Aryan. Mr. Childe's primary aim is to trace this expansion by locating the various Aryan-speaking peoples as they enter the stage of history, and then to trace them back to their common centre by means of archaeological remains. He then seeks to identify the primitive culture and cradle of the Aryans among the culture groups and provinces of the prehistorian, pinning them down to a definite locality by purely archaeological evidence.

It cannot be said that a great deal of light is thrown upon the problem by an examination of the evidence upon which the first part of Mr. Childe's inquiry is based. The Aryans first appear about 2000 B.C. Recent investigation of inscriptions from Boghaz Keui and elsewhere in Western Asia have revealed an Aryan element among the Mitanni and the Hittites, but the evidence is difficult of interpretation in regard to the extent and quality of the Aryanization of the population. Again, from literary records it is possible to place the Aryan invasion of India at somewhere after 1400 B.C.; but the archaeological evidence recently acquired from the Punjab and Scinde, which appears to point to a connexion between India and Mesopotamia, has as yet revealed nothing which can be related to the influx of a race bringing in a new and distinctive culture such as is attributed to the Aryans. Nor can anything of a more decisive character be derived from Iran or the Mediterranean, though in both cases there is more material available for discussion, especially in the obvious break between the Minoan and later cultures.

Mr. Childe, therefore, after a brief sketch of Aryan culture as it may be reconstructed by the help of linguistic palaeontology, turns to the various possible centres of culture in early times and examines the archaeology of each in turn to see how far it might have fulfilled the necessary conditions. The possibilities of an Asiatic cradle, the favourite hypothesis of the early phases of the controversy, of Central Europe, of Scandinavia, and of Southern Russia, are each examined in turn. In the last-named he finds climate and physiographical features and earliest connected remains of post-glacial man, which on the whole correspond with the conditions and culture postulated for the Proto-Aryans. Here in graves are found interred contracted skeletons covered with red-ochre of a tall dolichocephalic people who, in a word, are Nordics. Their culture is uniform over the whole area from the Caspian to the Dniepr. Mr. Childe puts forward some very cogent arguments for his view as against the Germanist hypothesis, not the least strong of which is the way in which he accounts for the origin and distribution of the perforated axe, a typical Nordic weapon.

It is impossible within the compass of a brief review to deal with the mass of archaeological data which Mr. Childe has here set forth in an orderly manner. His book, quite apart from its main purpose, is a wholly admirable summary and analysis of our knowledge of this early phase of the archaeology of Central Europe and the nearer East.

E. N. F.

(1) *Scott's Polar Journey and the Weather.* By G. C. SIMPSON, F.R.S. (Oxford University Press. 2s. 6d.).

(2) *Man and Weather.* By A. MCADIE. (Oxford University Press. 8s. 6d.).

(1) In the first of these books, Dr. Simpson has published his Halley Lecture, delivered at Oxford in 1925. It is well known that bad weather in the closing stages of the journey was largely responsible for the disaster which befel Scott's polar party. Dr. Simpson has analysed the temperature records taken by the polar party, and the simultaneous records taken at the base at Cape Evans, and has shown, fairly conclusively, that the conditions encountered by Scott were abnormal. On the return journey, as the party descended the Beardmore Glacier, from the plateau, the temperature rose, as was to be expected, but on 11th February, while they were still in the glacier, a change set in; the temperature fell rapidly, and − 40° F. was reached in March, on the Barrier, when the records ceased. The low temperature, bad enough for men nearly exhausted, was accompanied by still air and a surface covered with frosty rime which increased terribly the labour of hauling the sledges. Scott, in fact, in his diary, actually longs for a blizzard to clear up the surface, and to make it possible to get some help from the wind by hoisting sails on the sledges. For thirty-nine days these conditions lasted, and when at length the gale which dispersed the great pool of cold stagnant air came, it was too late. The wind blew too strongly and was accompanied by blinding drift, which prevented the exhausted men from reaching the depot only eleven miles from the spot where they died.

Dr. Simpson's data make it clear that the meteorological conditions prevailing on the Barrier in the autumn of 1912 were abnormal, and that fortune was against Scott. The pamphlet makes very interesting reading, and should be consulted by all students of polar travel.

(2) Prof. McAdie's book also is based on a series of lectures, delivered in America. It aims at giving a popular account of meteorological matters, free from technical details. The first lecture deals with the influence of weather on warfare, and discusses matters as far apart as the crossing of the Red Sea and the Battle of Jutland, but nothing of very special interest is put forward. The second lecture deals with the importance of weather in peace time. We on this side of the Atlantic need but little persuasion of this, and may perhaps legitimately doubt whether the examples given really strengthen the case sufficiently to be worth putting in book form.

The remaining chapters are of a more technical nature. That

on the structure of the atmosphere is of interest, but it is a pity that the author gives so much prominence to a scale of temperature on which the freezing point of water is taken as 1,000°, and the absolute zero as 0°. This merely has the effect of making the fundamental interval between the freezing point and the boiling point of water, on which all practical standardization of thermometers must be based, contain a number of degrees not a whole number, without introducing any real compensating advantage. The author also confuses degrees of temperature and units of heat, not once but several times, and calls millibars "kilobars." For a book seeking to avoid technical language to talk of potential temperatures, logarithmic scales, and entropy, seems to us strange. Prof. McAdie is evidently conscience-stricken, for he says, "the conception of entropy is difficult, and perhaps the phrase which best conveys this idea is the running down of heat." We agree that the conception is difficult, but cannot feel that this explanation would make it any less so even had it been correct.

There is a good deal of interesting information in the book, and some good photographs of clouds, but the whole is marred by a looseness of expression which is made to do duty for a popular treatment. It is a pity that writers should confuse these very distinct things.

R. W. J.

(1) *Reflections on the Structure of the Atom.* By FLORENCE LANGWORTHY. (Watts & Co. 12*s.* 6*d.*).

(2) *Readable Relativity.* By CLEMENT V. DURELL. (G. Bell & Sons Ltd. 3*s.* 6*d.*).

(3) *From Kant to Einstein.* By HERVEY DE MONTMORENCY. (W. Heffer & Sons Ltd. 2*s.* 6*d.*).

(1) Miss Langworthy's book will not do. The cover assures us that the authoress has attempted to explain the structure of heavy atoms as Rutherford and Bohr between them have attempted to do for the hydrogen atom. We are at once interested. But the more we read the more disappointed we become. We have rarely read so curious a mixture of facts, assertions, speculations and errors as this book contains. The authoress has quite evidently read widely and understood what she has read, but in her unsupported assertions she throws all prudence to the winds; a little more reflection on her part or, better still, the carrying out of a few experiments to test her views, would have avoided the unfortunate publication of this book. Briefly her view is that whereas in the Rutherford-Bohr atom all the positive charges are placed in a central nucleus-sun while the negative charges act as planets, in her model there is a central sun composed of double-positives, while single positives and electrons go to the formation of the planets. This novel view is explained with much enthusiasm but often with a disregard for revealed truth, and occasionally with such sweeping assertions that γ-rays consist of atoms of hydrogen, the infra-red radiation of hydrogen molecules, and that the Cambridge school of physicists is suffering from an old-man-of-the-sea complex.

(2) The senior mathematical master at Winchester has written an excellent little book on relativity. In form it appears to be another attempt to make plain the main points of Einstein's theory of relativity. In fact it is a very fine piece of work, explanatory, informed, containing a good deal of wise writing, written by an educated man for educated people who are not necessarily mathematicians. It is a pity that schoolmasters so seldom write this type of book, because the explanation of things is their job. They have this advantage also over the ordinary writer that they have at hand the boys in their class on whom to try their explanation and from whom they can learn the real as opposed to the imagined difficulties of the subject. A schoolmaster is also usually exact in statement, and this is a very great merit in an exposition of relativity. Mr. Durell has added to these advantages a native gift for making things interesting, and his references to "Alice in Wonderland" are particularly apt. Lovers of "Alice" who are not devoid of mathematical knowledge should see this book. The ten chapters deal with the progress of science, "Alice through the looking-glass," the velocity of light, clocks, algebraic relations, separations of events, the fourth dimension, mass and momentum, general relativity, and the Einstein tests.

(3) Mr. de Montmorency starts off bravely. Kant's fundamental idea is that within the scope of knowledge, time and space are absolute. Einstein, on the other hand, bases his theory on the relativity of time and space. It is the purpose of this book to ascertain if it be possible to reconcile these conflicting views. A reviewer might ask why a reconciliation is necessary and, if such be possible, might be pardoned for doubting that it can be done in thirty-seven pages of philosophical and mathematical jargon. The author jumps lightly from subject to subject, now quoting from Kant, then talking of Lorentz's equations of transformations. In one sentence Sir Oliver Lodge is likened to Spinoza, in the next to Kant; a reference is made to Fitzgerald here, an allusion to Bergson there; from the special theory of relativity to Kant's "Prolegomena" he passes swiftly quoting confusedly and uttering oracularly. Out of this jumble little emerges except a vague impression that the author has read widely and has something to say which he is unable to convey to his readers.

A. S. R.

(1) *The Language and Thought of the Child.* By JEAN PIAGET, Professor at the University of Neufchatel and at the Institut J. J. Rousseau, Geneva. (Kegan Paul, Trench, Trubner & Co. Ltd. 10*s.* 6*d.*).

(2) *Psycho-Analysis for Normal People.* By GERALDINE COSTER, B.Litt., Oxon, Principal of Wychwood School, Oxford. (Oxford University Press. 2*s.* 6*d.*).

Something like a revolution has broken up psychology during the last ten or twelve years, and has followed the normal course of revolutions in other spheres. The exuberance and fanaticism which was exhibited by not a few of the exponents of the new analytical psychology seems to be dying down and, although the whole-hearted followers of each school may still feel themselves to be divided from one another by an impassable gulf, the truth seems, to a number of independent workers and to the younger generation, to belong not quite exclusively to one side or the other.

It is from this last point of view that the two books under review are written, for the authors do not belong to any of the schools into which analytical psychology has divided, but are prepared to use the new theories in so far as they find confirmation for them in the work in which they are engaged.

(2) Professor Piaget's method is to take down the entire spontaneous conversation of some children between the ages of five and a half and seven and classify the material thus obtained. Although no new facts have been brought to light, this purely objective method has served a useful purpose in confirming the egocentricity of the child, which has been emphasized by the analytical school of psychology, and tracing its diminution as the child grows older and the reality principle begins to assert itself with the consequent increase in the social habit of mind. The book suffers a little from a certain narrowness, both in outlook and in the selection of material; for the data are

confined almost entirely to the conversations of two small boys taken over a period of one month at a play-school, the Institut J. J. Rousseau, at Geneva, and the author is almost naively surprised that the conversation of two little girls taken down outside the school contained elements which were not found in the other material collected. Professor Piaget seems to see a sharper difference between the mode of thought of children and adults than most psychologists, but his work cannot be fairly judged by the present volume, which is intended as a prelude to a wider discussion of the subject. Professor Claparède contributes a eulogistic preface, and Marjorie Warden has made a smooth and easily read translation of the original French text.

(2) Miss Coster was trained in the old academic school of psychology, but declares whole-heartedly for the new. She too writes with a sense of humour which, with its implied sense of proportion, is not among the commonest gifts of the many writers upon analytical psychology, and those who have neithre the time nor the taste for the psycho-pathology of the technical works of Freud, Adler and Jung will appreciate her little book. It makes no claim to originality, but sets out to clear away some of the misunderstandings which have distorted the popular view of psycho-analysis and to explain the temperamental difficulties of quite normal people and children.

Miss Coster does not wholly accept any of the schools of analytical psychology, but believes that the protagonists of each are " merely looking at truth from a different angle " ; she rejects the rigid determinism of Professor Freud, and in the last chapter correlates Jung's conception of " libido " with the Christian doctrine of the Holy Spirit, but Adler's theory of the will to power is used in preference to the equivalent " Narcissism " of the Freudian school, only because it is simpler and easier to explain, and not because it seems to be nearer to the truth of things.

Very occasionally the author is just a little too human in her treatment of the subject, and in the chapters on " Fear " misses the point of view that, howsoever uncomfortable fear may be, it once served a biological purpose and sometimes does so still. But the omission is not very serious, for the book is essentially practical, and fear to the ordinary man or woman is a disagreeable handicap, and the important thing is to learn that there is an effective way of getting rid of a great deal of it, together with the disabilities of which it is the (often unsuspected) cause.

F. A. HAMPTON.

British Snails : A Guide to the Non-marine Gastropoda of Great Britain and Ireland, Pliocene to Recent. By ARTHUR ERSKINE ELLIS. With illustrations by R. A. ELLIS. (Oxford : Clarendon Press.)

Mr. Ellis' book is to be warmly recommended to all field-naturalists and other students of the British fauna. The introduction contains so much interesting matter, and the author's enthusiasm is so infectious, that it should also attract many laymen to take up the study of the Mollusca. The experienced collector and the professional zoologist will find the book useful, as it gives a concise statement of the habitat and distribution (recent and fossil, with indication of the range outside the British Isles) of each species with notes on the varietal forms. It is therefore fuller than L. Adams' useful manual, but not so complete as Taylor's exhaustive " Monograph." From the point of view of the field-collector the present work would have been more useful if Mr. Ellis had included the fresh-water Lamellibranchia (mussels and cockles) as Adams does. There is a very useful and well-documented essay on the origin of the non-marine Mollusca, which is quite an important contribution to our knowledge on this subject. Mr. Ellis includes notes on collecting, preservation, and the breeding of snails in captivity. Throughout the work he manages to keep before the reader a picture, not of dry shells and cabinet specimens, but of living animals with peculiar and individual habits occupying a special " niche " in their environment. The book stimulates the reader to observe the habits and " household affairs " (ecology) of animals, and in so doing it performs a valuable service ; for when the energies of the field-naturalist are concentrated upon the acquisition and recording of such observations the study of evolution is facilitated and enriched.

The figures supplied by Mr. R. A. Ellis (photographs and drawings) are with one or two exceptions very good ; though to my mind photographs can never be as satisfactory as drawings for giving a clear idea of the essential character of molluscan shells. In some of Mr. Ellis' figures the lighting obscures characteristic features. Thus the figure (No. 17 of Plate X) of *Cochlicella acuta*, var. *strigata*, does not do full justice to the " strigate " pattern. The orientation of the shells is not always very satisfactory. For example, the figures of *H. lapicida* on Plate X should include one showing the characteristic lenticular profile.

G. C. R.

The Elements of Chemistry. By WILLIAM FOSTER, A.M., Ph.D. (D. Van Nostrand Co., New York. $2).

Some years ago Professor Foster published an Introduction to General Chemistry" and his new book very largely covers the same ground. It is, however, of more general interest, because throughout the book the industrial applications of chemistry are stressed and are profusely illustrated with photographs supplied by leading American chemical and metallurgical concerns. But while the author has the practical applications of the science in mind, he is one of those who believes that " a thorough course in chemistry is based upon fundamental principles, and this," he says, " is the only way to discipline the mind and to lay a broad and solid foundation."

The book is intended for beginners in the subject, but it goes into rather more detail than is usual in the elementary textbook. Although the beginner may find it necessary to omit much of the matter in the first reading of this book, it is throughout written in non-technical language. It was at one time supposed that anything written in such a way as the ordinary layman could understand it could not be at the same time scientific, but this idea is fortunately becoming rapidly out-of-date, a change which is due more than anything else to the clear writing of many modern authorities.

As anyone who has studied under Professor Foster will agree, he is one of those who possesses in a rare way the faculty of expressing himself very clearly on technical matters.

J. A. B.

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